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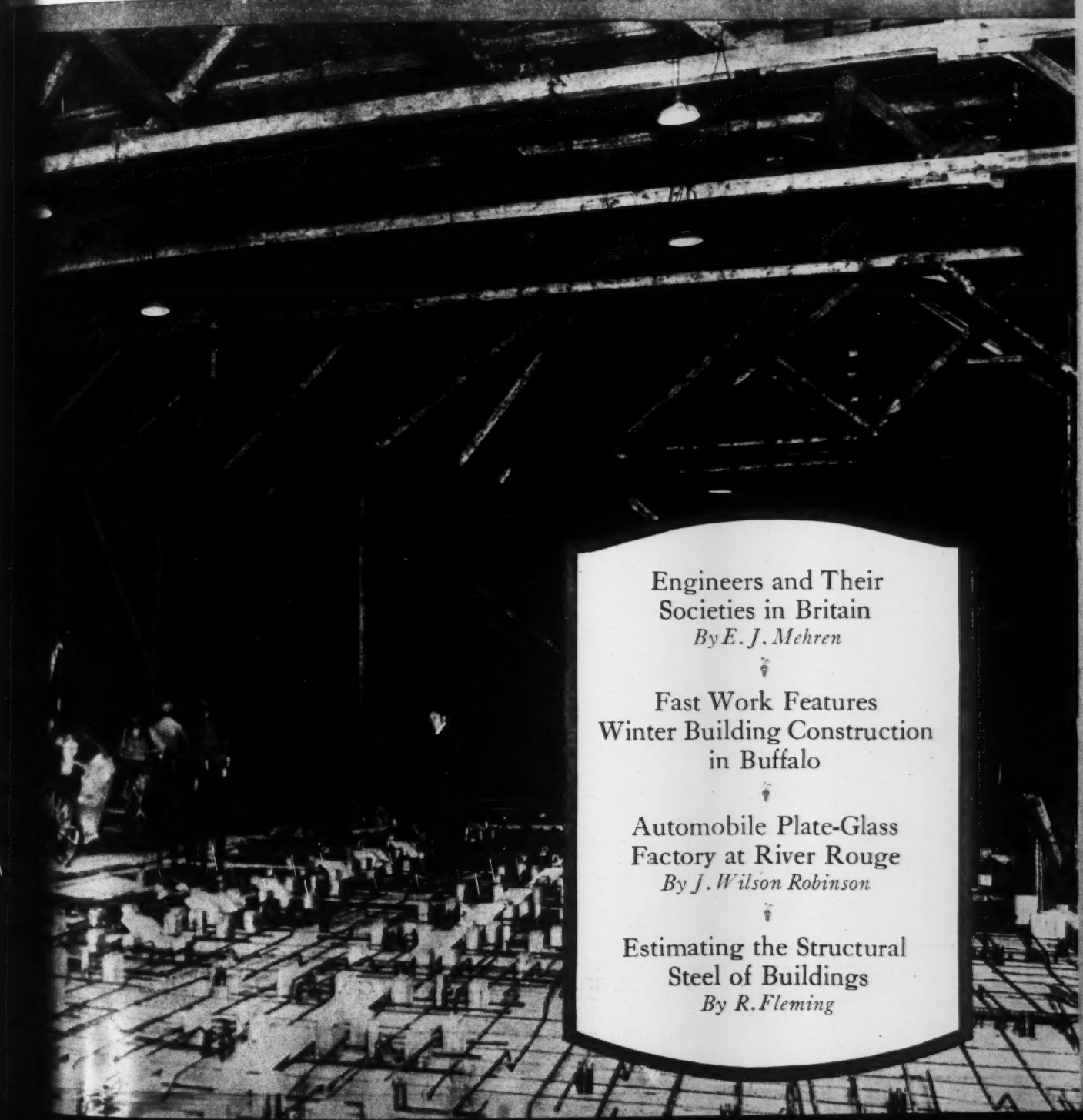
Engineering News-Record

September 4, 1924

Tower Concrete Job—Buffalo Building Entirely Enclosed While Being Poured



Engineers and Their Societies in Britain
By E. J. Mehren

Fast Work Features Winter Building Construction in Buffalo

Automobile Plate-Glass Factory at River Rouge
By J. Wilson Robinson

Estimating the Structural Steel of Buildings
By R. Fleming

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DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

FRANK C. WIGHT
Editor

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Ford May Change Attitude

THERE are rumors from the Vermont hills that when the Ford-Edison-Firestone caravan got through viewing ancestral sugar pails on the Coolidge back-porch the talk got around to Muscle Shoals and that the President was successful in getting Mr. Ford to agree to some change in his hitherto inflexible offer for the Tennessee River power and nitrate plant. Let up hope that Henry's good resolution persists after he gets away from the combined New England and presidential atmosphere. With proper acknowledgment of the validity of our water-power law Mr. Ford would be one of the most acceptable developers of Muscle Shoals. It is only because he has wanted to make himself—and his successors—above the law that his offer has been held unacceptable. The advocates of Ford have from the beginning been victims of sentimentality, not reason; if their idol becomes reasonable they will find many who will go along with them.

An Old Story Repeated

THE recent outbreak of typhoid fever at Havana, Cuba, recalls like happenings in American cities twenty or thirty years ago: Lavish use and waste of polluted water with little or no attempt to control the waste or correct the pollution by checking it or by adopting water purification. Meters at Havana might cut consumption in half or increase the water revenues, in either case facilitating the financing of filtration. At Havana, chlorination has been practiced irregularly when both it and filtration should have been used constantly. Inoculation, since the outbreak, seems to have been the chief reliance—like locking the barn after the horse is stolen. With nearly 600 cases and 90 deaths from typhoid in July and August alone, it is time that Havana citizens and officials take effective measures to safeguard their water supply, not forgetting the aid to that end that metering would give.

Tying the Boy to the Man

THE class dumbhead who becomes a millionaire and the class leader who never rises above obscurity are commonplaces of the funnyman. They have become almost a tradition of belief among college men, despite statistics which purport to show some relation between standing in school and in the world thereafter. These statistics are not taken too seriously, probably, because every college man knows of his personal knowledge some associate whose post-college career is utterly at variance with his college performance and these instances outweigh the possible following of form of the great majority of his fellows. Nevertheless there seems to have been neglected in the study of our educational system the possibility of making some kind of check between what a man does at school and what he becomes afterward. Someway, somehow there might be evolved a relationship between the reactions and behavior of the youth and the performance of the man, so that the reactions and behavior of future youths might be better understood. The new science of psychology has come to the aid of such possibilities but even it has not as yet been perfected to such a degree as to guarantee results. The attempts along this line, such as the one described in these pages last week by Dean Potter of Purdue, are most interesting. Maybe they will in the future be able to tell us why certain men we have known have succeeded as engineers in spite of all collegiate indications to the contrary; but the method will be useful as well as interesting if it can be used to control curicula and point out collegiate paths for undergraduates.

Good Winter Construction

NOT every piece of winter construction has a covering shed so handy as the Buffalo building described in this issue, but at the same time not every contractor would have been so alive to the possibilities of that shed as was the Cowper company. The whole operation indicated a very lively sense of the possibilities of winter construction in concrete and a proper appreciation of the necessities of that kind of construction. Some time ago in criticising the details of a piece of winter construction that resulted disastrously we had occasion to remark that the failure in question need not deter constructors from going ahead with winter concrete work, provided certain well known precautions were taken. The Buffalo job is an excellent example of one way of taking those precautions.

Lowest Responsible Bidders

IN NEVADA the highway-department officials are being praised by contractors for their announcement that hereafter the lowest bidder will not get road contracts unless he can show a clean record of work finished on time. Instead, a higher bidder, with a clean record, will be chosen. Up in Eugene, Oregon, another group of contractors is at the same time censuring the city councilmen because they passed by the lowest bidder on paving work and chose another and a local man because they felt that they would thus get better contract service. In both cases it is again the old question: Who is a responsible bidder? This is the rock of doubt upon which every plan of reform in appraising bidders which contractors have launched has split and spilled its cargo of good intentions and laudable purposes. General opinion and practice holds that whoever can give a bond guaranteeing performance is a responsible bidder and that if at the same time this bidder names the lowest price he should have the contract. Contractors and engineers deny that responsibility is measured by ability to furnish a guarantee bond but offer no other measure which they themselves can agree upon. Indeed, it is not possible to provide a definitely determin-

ing measure of contracting business and technical responsibility. What have we then which is better for practical use than the measure of money guarantee which the public has set up? If there be no better standard, the conference of engineers, contractors, and surety men on contract bonding reform, which will be held this month, can by wise action go a long way in stabilizing the contracting business.

Track Stresses and Locomotives

THAT THE problem of stresses in railway track is one in which the locomotive designer has an interest and a responsibility was shown forcibly by the remarks of C. T. Ripley, chief mechanical engineer of the Atchison, Topeka & Santa Fé Ry., noted in last week's issue. His presentation is very timely in view of the increasing size, weight and wheel loads of locomotives within recent years, and in view also of the fact that as a rule in the design of locomotives too little attention is given to the effect upon the track. As Mr. Ripley pointed out, economic conditions preclude any such step as reducing the size of locomotives in order to favor the track. But engineering departments are endeavoring to improve the rail and the track structure, and it is not proper for mechanical departments to "pass the buck" to the former by saying that it is up to them to build a track structure that can carry the load. It is really a joint problem, for which reason locomotive designers should endeavor to design machines which will not produce excessive or unreasonable stresses in the track. In doing this they will reduce excessive or undesirable stresses in certain parts of the locomotive and thus reduce locomotive maintenance costs as well as track maintenance costs. A difficulty not mentioned by Mr. Ripley is the change in condition of locomotives during service, on account of repair work, yielding springs and other causes. Probably many locomotives would on investigation show material differences in load distribution and counterbalance effects from those of the original design or of the engine when built.

Los Angeles, The Second Port

SOME weeks ago the Shipping Board published a statement of water-borne commerce of the ports of the United States which placed Los Angeles second in the list, on the basis of tonnage handled. This was somewhat of a surprise as heretofore Philadelphia, Baltimore, New Orleans or Galveston had occupied the places immediately below New York. Closer examination of the statement revealed the fact that the Shipping Board for some unknown reason disregards all coastwise shipping except that which moves between the Pacific and Atlantic ports, taking no account of that considerable amount which moves between neighboring ports on the same ocean as between New Orleans and New York. Here we thought was the discrepancy in the Shipping Board's figures and so appealed to the Chief of Engineers for a transcript of his figures for water-borne traffic, as his office takes account of all of it, including local coastwise and internal port traffic. To our further surprise the Chief of Engineers' figures, based on the total traffic, also award second place to the port of Los Angeles; the figures for coastwise traffic making no material change, for although the Shipping Board's figures exclude the considerable traffic along the Atlantic Coast they also exclude a large amount of Pacific Coast traffic to and from Los Angeles, offsetting the advantage which was expected to accrue to Atlantic and Gulf ports. According to these figures for 1923, Los Angeles is in second place in foreign and domestic traffic with 27,154,550 tons, Philadelphia third with 15,230,449 tons, New Orleans fourth with 10,264,257 tons, and Baltimore fifth with 10,155,504 tons. New York's figures for 1923 are not available, but the total is about 48,000,000 tons, exclusive of internal traffic. The figure for Los Angeles for 1923 is an increase of almost 17,000,000 tons over the 1922 figure. Needless to say, the bulk of the increased traffic is oil. But it alone is not responsible, for Los Angeles leads also in lumber and has a large miscellaneous traffic. The famous shoestring acquisition which moved Los Angeles to the sea is beginning to justify itself.

Disabilities of State Owned Power

STATE ownership of power, if or when it comes, will not result from well reasoned estimates of the relative benefits to the people of the state-owned versus the private-owned plant. A few enthusiasts for public ownership of power have really worked out the economics of the case but these men are rarely vocal. The noisiest advocates (and they are the ones whom the majority of voters may be expected to follow) are afflicted with two obsessions: the first, which is completely erroneous, is that water power costs little or nothing and that nature's great resources are going to waste because of communal apathy or capitalistic greed; the second is the fear of too great extension of private control of so crowning a necessity as power has come to be. To avoid that possibility the unknown dangers of government ownership are freely approached.

It would be highly desirable if the people who are easily influenced by these views could read—and appreciate—the paper which ex-President Arthur T. Hadley of Yale University read at the recent World Power Conference at London. Dr. Hadley did not argue against government ownership in general nor did he deny that possibly some time the government ownership of power will become desirable, but he drew a lesson from the fact that government management has been fairly successful in standardized industries and habitually unsuccessful in progressive ones. It is not necessary more than to state that power development is far from being standardized and comes in the forefront of the progressive industries.

Dr. Hadley's arguments were familiar enough—but they bear repeating. Experimenting, both in technical and business details, is the very life of a progressive industry. To remain satisfied is to go backward. But experimenting only sometimes succeeds, the real success paying for the cost of all the failures and half-successes. It takes private initiative to do this experimenting; those delegated by the government to operate its own plants cannot—or at least history shows they do not—dare take the chances of failure that experimentation involves.

But more than that, according to Dr. Hadley, there is a fallacy underlying the expectations of lowered cost to the people of the publicly owned power plant. Tax exemption, the first explanation of lowered cost, is a pernicious practice. Obviously it costs just so much to run the government whether power is publicly or privately managed. If the power plants do not pay their share

of taxes something or somebody else must. It is a mere shifting of charges and the people have to pay them in the long run. Nor does Dr. Hadley consider the sinking fund a compensation for the tax, first because the sinking fund is not a current contribution to the general expense of government and second because in the history of government operation the sinking fund has only rarely succeeded in complete amortization. As a rule depreciation and more especially obsolescence have been underestimated. To lower costs by reducing or abolishing profits is still more precarious, according to Dr. Hadley, in the progressive industry, because it is the expectation of profits, within governmentally controlled limits, of course, which leads to that scientific and business experimentation which reduce costs and therefore rates.

The answer is that the expected benefits from publicly owned power are illusory, or at best are based on unfair premises. If government must go into power production as the only way to guarantee a proper charge for power to the people, let it go into it on a fair basis which will permit a proper comparison of costs. Let its accounting be open and aboveboard, let it pay its proper share of taxes and let it be subjected to the same regulation as the private enterprise. Even then it will be difficult to tell whether or not the people are profiting. The greatest example of public ownership today, the Hydro-Electric Power Commission of Ontario, is a financial mystery which no one has succeeded in penetrating. Apparently, its rates are lower than those of private companies—even of those who enjoy the same unique advantages of continuous water power—but its own books show that by dividing the total output into the total investment its development has cost somewhere around $250 per horsepower and no private company on earth could make money or even expenses on such an investment at any rate that it could charge in competition. There is a joker somewhere—and time will bring it out. The probabilities are that the joker will be found in the explanations of the disabilities of state-owned power made in Dr. Hadley's paper.

The Golden Dustman at Washington

RECOVERY of over $300,000 a year from the garbage and rubbish of Washington, D. C., in the year ended June 30 last challenges attention. If a city of something less than a half million people can get that much money in a year to help meet the cost of its garbage and refuse service, why should not others do proportionately well? How many, larger or smaller than Washington, can make so good a showing or show any material revenue from this source? Unfortunately, data in this field of municipal enterprise are so few and so poorly comparable as to make specific answers impossible.

The Washington figures, carefully recorded so far as they go, fail completely when examined to determine what it cost to reclaim some $300,000 from the garbage and "trash" or rubbish of Washington. The reason for this is that accounting for the City Refuse Division of Washington, like practically all federal, state and most city accounting, is on a cash-receipt and cash-payment or fiduciary basis, designed to show nothing but whether there has been theft or misappropriation of allotted funds. There may be more or less attempt at unit-cost accounting but almost never does it take all cost elements into account. As a rule, capital charges are ignored. Where included, they are likely to be incomplete. Overhead management expense, interdepartmental services, insurance, etc., etc., are also usually ignored.

Reverting to the Washington garbage and refuse collection and disposal figures, what they show is (1) that under a mere cash accounting system, in which capital and operating charges are lumped, no allowance made for depreciation but replacement charges debited to yearly costs, and leaving out interest, $821,000 was charged against the City Refuse Division and $303,000 credited to it, reducing the total charges for collection and disposal of garbage, dead animals, night soil, "trash," and ashes to $518,000; and (2) considering only the final disposal of garbage and of "trash," the garbage credits exceeded the debits by nearly $29,000, while, in like manner, there was a "trash" credit of nearly $7,000. What commercial accounting would show, there are no direct figures to indicate. The plant replacement charges for the past year may have been disproportionately high or low to offset proper depreciation charges for the same period. The "trash" plant account is simplified by the fact that the plant is rented, not owned by the district; but it is thrown out of all true relations to the net results of the trash disposal service by the fact that $9,000 was paid for land adjoining the plant bought by the district in December. This capital outlay, instead of standing as such, was all charged to the cost of trash disposal, reducing the revenue account by nearly that amount, since the interest on the purchase price for six months would have been a small charge and presumably no depreciation charge for the land would have been required. The true revenue for "trash" disposal, therefore, would seem to be nearly 150 per cent. more than that shown.

The system or lack of system of accounting in this Washington case makes it impossible to tell what the cost and efficiency of the service is, in (1) any year by itself, (2) as compared with an earlier year, or (3) as compared with the same processes of disposal in other cities and, last but not least, as compared with any one of the other possible means of disposal that might have been or might yet be adopted for Washington. For all the Commissioners of the District of Columbia, or the Budget Bureau, or Congress, or the President, or the people of the United States know, it might be cheaper to dispose of the garbage and "trash" of Washington by some other method of reclamation, or to give up any attempt at reclamation, especially of the garbage.

If this muddlesome method of accounting were confined to the Washington refuse division alone, it might be ignored, although deserving condemnation, but, as already pointed out, it is rampant in almost every sort of public works or service conducted by our federal, state, or municipal governments. And yet, from president to people, mounting public debts and taxes are deplored. Why not turn the energy wasted on official protest and popular grumbling into efforts to secure accounting reforms, comparable unit costs and the establishing and achieving of efficiency standards? The federal government might well set the example. The District of Columbia, so far as municipal services are concerned, affords a splendid opportunity. The Budget Bureau might well give the whole subject careful attention.

Fast Work Is Feature of Buffalo Winter Construction

Large 8-Story Reinforced-Concrete and Brick Building Closed in Less Than Three Months in Midwinter—Old Structure Used as Part of Housing—Unusual Formwork

BY TAKING advantage of the fact that the shell of the old mill building of the Russell-Miller Milling Co. at Buffalo, N. Y., was wider than the greatest width of the new building, the contractor for the new building was able to provide a complete housing for seven stories of the latter building with a relatively small amount of new material, and at a great saving in time on a winter construction job where time was of great importance. Moreover, the complete housing of the mixing plant, elevators, and stock piles during the severe part of the winter made the work entirely independent of weather conditions and made possible a construction program as rapid as if not more rapid than summer construction in the open where rainstorms frequently cause a complete shut-down of the work.

When the contract for the new building was let Nov. 28, 1923, the work of wrecking the old building had already been let under a contract that originally called for the completion of the work by Dec. 5, in order that the old building would be out of the way of the contractors for the new building. The wrecking was, however, so far behind schedule that the major part of the side walls were still standing when the building contractor came on the job, and as the building contract called for its completion, exclusive of interior marble and tile work, by April 10, the contractor decided to take advantage of the backward condition of the wrecking work by using the old walls for housing, insofar as they could be used, and building on at the end where the new building was longer than the old and then carrying up a framework to support a temporary roof above the roof of the old building. The completed enclosure is shown in Fig. 1. By this arrangement it was also possible to set up the mixing plant and erect the lower portion of the elevator towers inside the old building at one side of the new, and to put in a woodworking shop in a similar position at the other side.

The owners agreed to postpone the wrecking of the remainder of the old building until spring, and permitted the building contractor to take over the wrecking contract. Work on the temporary enclosure was started Dec. 7, and by Jan. 2 completed to a height sufficient to cover the seventh floor. The enclosure, outside of the brick walls of the old building, was built of rough lumber, lined with building paper between the studs and the outside sheathing. No interior framing was necessary for the portion above the walls of the old building, as the roof was carried on wooden trusses spanning the full 70-ft. opening; but interior framing was necessary for the end portion and, during construction, the posts of this part of the enclosure were left in the concrete and cut off after the building was completed. The original enclosure was built to the height of the seventh floor and roofed over. This was done with the idea that in case some unforeseen delay made it impossible to carry out the building program, the weather might be sufficiently mild by the time the upper floors were reached to permit their construction in the open. As no such delay did occur during construction the original program was carried out almost to the day, and, as the weather was still severe when the upper floors were reached, the roof was jacked up, additional siding built and the seventh and eighth floor poured under cover. By the time the roof was reached it was possible to pour it in the open.

No openings were made to admit daylight into the

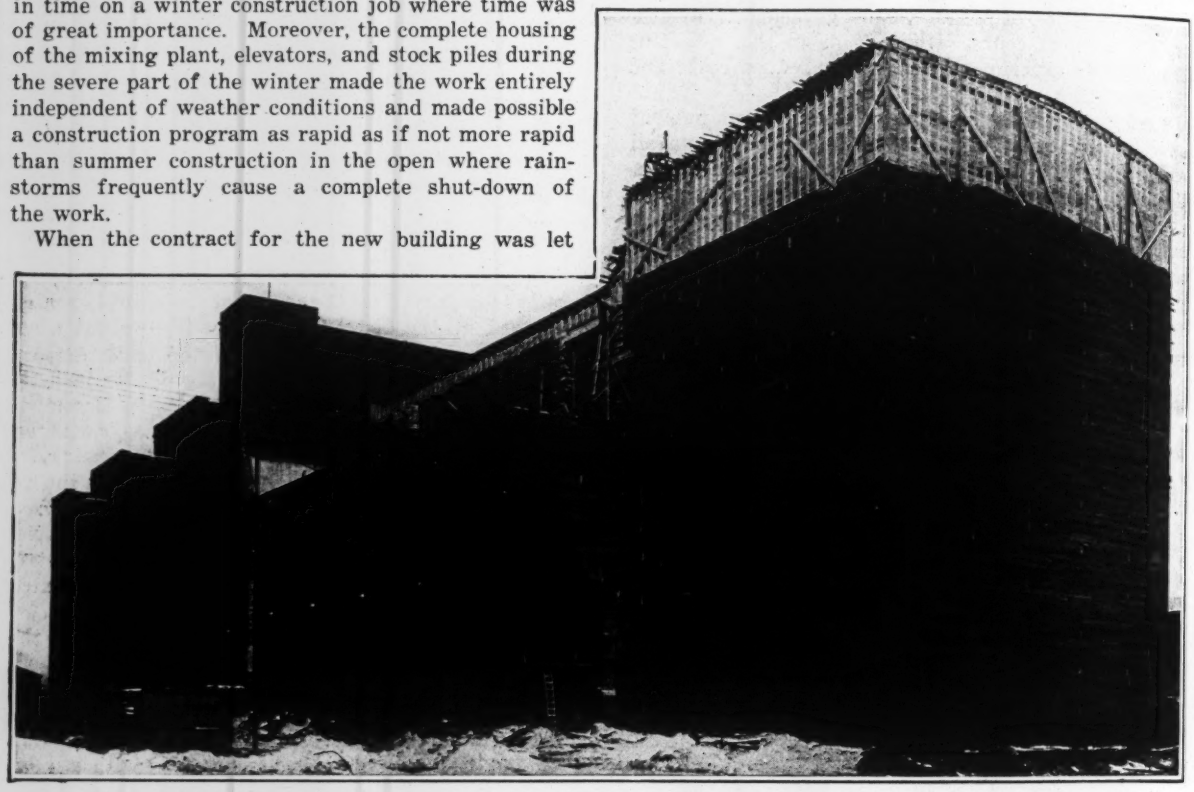


FIG. 1—ENCLOSED WINTER CONSTRUCTION ON RUSSELL-MILLER MILLING CO. BUILDING AT BUFFALO

enclosure, for it was realized that as the work was being done in short winter days it would be necessary to use artificial light in the morning and late afternoon,

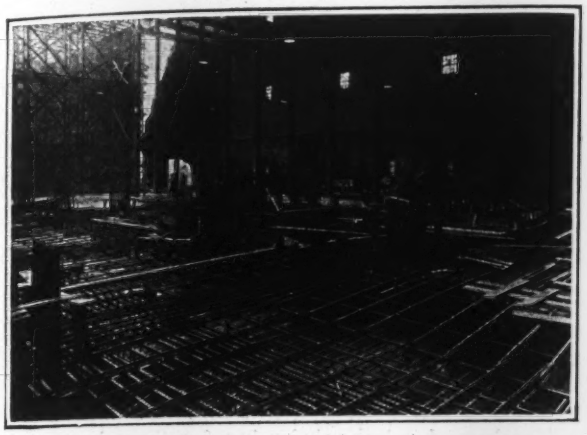


FIG. 2—THIRD FLOOR MAT FOR NEW MILL BUILDING
Showing portion of old building retained for the enclosure as well as interior framing for new part of enclosure.

and on dark days, no matter how much window space was provided. The saving in the cost of window openings far offset the cost of artificial electric lighting.

While the preliminary work of the enclosure was in progress, the footings and the concrete mat which made the first floor of the building, were prepared and poured. The mat is of heavily reinforced concrete laid directly on the ground but bearing on the old foundations which go to rock and carry the load of the structure in the old building. That portion of the new building extending beyond the old structure is carried on piers to solid rock. (The reinforcing of the mat, the interior framing of the new portion of the enclosure, and the retained portion of the old building are shown in Fig. 2.) The 1,200 cu.yd. of concrete for the mat were poured in one continuous operation of two days and two nights, Dec. 28-30. Although the enclosure was not completed at the time of this pouring, the weather was still moderate, the lowest temperature being 27 deg. F. on Dec. 30, and as the mat was thick and the gravel and water were heated the concrete set rapidly.

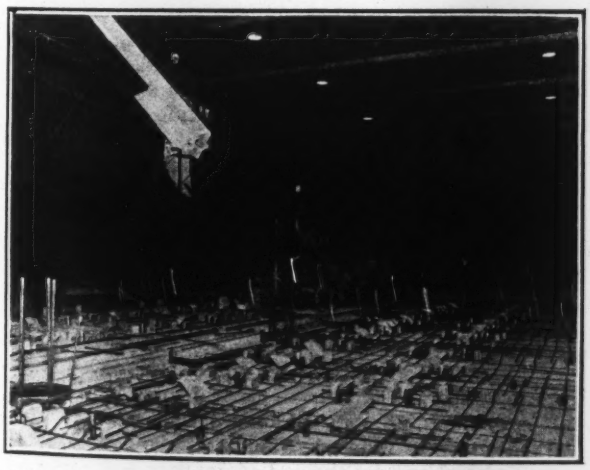


FIG. 3—TYPICAL FLOOR DETAILS OF THE MILL BUILDING
Showing formwork for anchor bolts and innumerable floor openings; also lighting units, and roof trusses of enclosure.

The concreting facilities consisted of a ½-cu.yd. mixer (19 cu.ft. rated capacity) located inside the enclosure close to one steel concrete tower, steel chutes, a portable hopper, shown in Fig. 3, concrete carts, wheelbarrows, etc. Niagara River gravel was used for the concrete aggregate. It was heated before being loaded for shipment to the job (its average temperature upon arrival being about 40 deg. F.), stored inside the heated enclosure, and reheated before it was used. The cement was stored in an unheated portion of the old mill, and was used without heating. Concrete for the columns was mixed in the proportions of 1:1:2 and for the girders and floors 1:2:4.

A separate elevator was installed for handling the brick and tile used in the outside walls.

The enclosure was completed on Jan. 2 and heat, supplied by 40,000 sq.ft. of radiation in coils heated by steam from the adjoining mill, was turned-on on that date. The accompanying table gives typical outside and inside temperatures, taken at ground level.

In the meantime, formwork for the columns and second floor had been begun. The structure, above the first floor, consists of a reinforced-concrete frame of

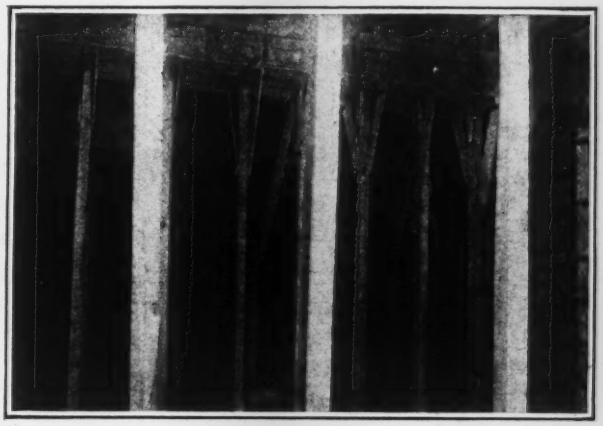


FIG. 4—DETAILS OF THE FORMWORK FOR THE GIRDERS

beams and girders, reinforced-concrete floor slabs of various thicknesses, and an outside shell of hollow tile veneered with a light colored pressed brick. The building, above the first story, is 50 ft. wide by 183 ft. long, eight stories high. The outer end of the building has a group of concrete bins extending from a mezzanine floor above the first floor to the level of the seventh floor. The outside walls of these bins are of concrete faced with brick. Insulation is provided by an air space of about one inch between the concrete and brick veneer face. The brickwork is anchored to the concrete by copper ties set in the concrete during pouring. Wooden forms were used throughout the building except for the columns. They were built with steel forms.

Concrete for the bins was poured at night when work on the other part of the building was at a standstill. It was poured in 4-ft. lifts, then, in the morning after the concrete had set somewhat, the forms were raised up a few inches at short intervals during the day by means of screw jacks attached to rods set in the concrete. This procedure kept the forms free from the concrete and prevented the outside ones from freezing to the concrete when, on account of the small space between that portion of the building and the enclosure,

there was a possibility of the temperature falling below freezing.

Due to the fact that the forms for the bins, though of wood, were slid along the surface of the concrete, it was impossible to put in ordinary brick ties in the usual manner of letting the outer end stick out through the forms. Instead, special ties were used. They were made of copper wire bent in the shape of a long narrow "U" with the legs bent over twice near the end. The long loops were slipped down between the fresh concrete and the inside of the forms at intervals during the pouring of the concrete, the legs being left on the surface where they would be covered as the forms filled up. Later, as the brick wall was laid, the loops were easily pried away from the surface of the concrete and bent out into place in the brick wall. Ordinary galvanized iron brick ties were used for the other walls of the building.

The method of building the forms for the beams, columns, and floors is shown in Fig. 4. The advantage of this method lay in the fact that the girder sides and the floor forms were supported on the ½-in. strips on the top of the caps of the posts under the girder forms. These strips were independent of the boards making up the bottom of the girder forms, and could be knocked out sideways without disturbing the girder bottoms or the posts. When so knocked out they released the girder side forms and the floor forms, thus making it possible to remove all the forms except the bottom of the girders without taking the support from under the girders. This arrangement made it possible to strip the forms at a much earlier date than would have been possible under other conditions, and did away with the necessity of reshoring.

FIG. 5—COMPLETED EXTENSION TO MILL BUILDING

The hooped spiral reinforcing for the columns and the reinforcing for the beams and girders was assembled at the manufacturer's shop and shipped to the job collapsed. Other reinforcing was assembled as placed. Formwork for the floors and the work of pouring the floors was complicated by the large number of anchor bolts and openings required to be left in the floor for belts, conveyors and shafting. Some of this work is shown in Fig. 3.

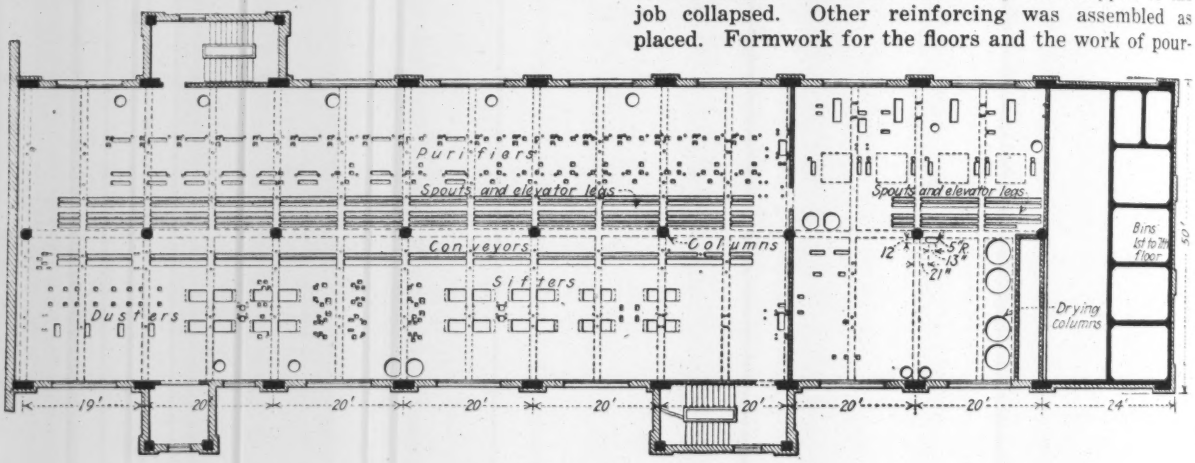


FIG. 6—TYPICAL FLOOR PLAN

Progress—Once the housing was completed the work went along rapidly without any delays due to weather, despite the storms and low temperature outside. The progress chart, shown in Fig. 7, indicates how rapidly the building was carried up. The only long break in the regularity of pouring occurred after the sixth floor was poured. By that time the underside of the temporary roof trusses had been reached, and the roof had to be jacked up and the side walls raised before the seventh and eighth floors could be poured. When the roof was reached the weather had moderated and it was possible to pour it in the open.

At the start of the job the force, exclusive of foremen, engineers, and a small clerical force, consisted of 103 carpenters, 18 iron workers, and 46 laborers. The carpenters were reduced to 80 after the enclosure had been finished and by the end of January were down to 60. The number of laborers remained about the same throughout the work.

TEMPERATURES DURING WINTER CONSTRUCTION OF RUSSELL-MILLER MILLING CO. BUILDING

Taken morning and evening of days when floors were poured.

Date	Outside A.M.	Outside P.M.	Inside Enclosure A.M.	Inside Enclosure P.M.
January 12	31	24		46
18	32	13	52	64
29	41	33	57	52
February 5	39	21	54	52
13	15	8	46	45
26	29	11	37	40
March 5	34	30		

During January the minimum night temperatures outside were around zero the lowest being —7 deg. During February the lowest was zero.

The first floor slab was poured as a continuous operation and the bins were poured at night, otherwise the work was all done in an 8-hr. day.

It will be seen from the table of temperatures that the temperature inside the enclosure was not unusually high, yet, despite this fact there was no abnormal delay in the setting of the concrete nor was there any trouble from stripping concrete that was too green. Tests made on March 10, on concrete a week old, showed it to be in excellent condition, while concrete in the lower

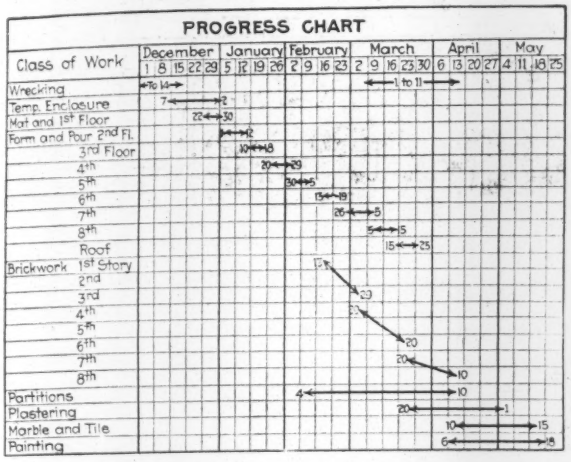


FIG. 7—PROGRESS CHART

floors of the building, less than six weeks old, had the ring of old concrete when struck with a hammer.

The mill was built for the Russell-Miller Milling Co., of Buffalo, N. Y., as the first unit of their reconstructed plant. The John W. Cowper Co., engineers and contractors, New York and Buffalo, had charge of the design and construction of the building. Nordyke & Marmon Co. of Indianapolis, Ind., designed and supplied the machinery, delivery and installation of which was started on May 1, or about four months after the first concrete was poured.

Demolition of the Batignolles Tunnel

The work of changing the Batignolles tunnel of the Chemin de Fer de l'Ouest-Etat in Paris to an open cut is entering its last phase. The group of tunnels consisted of four double-track tunnels at the approach to the St. Lazare terminal of the French State Ry. The present work consists in converting three of the tunnels into an open cut with eight instead of six tracks as at present and the retention of one double-track tunnel (*Engineering News-Record*, June 14, 1923, p. 1037). To date, the bridges carrying two streets across the open cut have been completed, as well as one at a lower level to carry the tracks of the metropolitan subway. The new retaining walls at the sides of the cut have been built and a large part of the 125,000 cubic meters of earth and 15,000 cubic meters of masonry have been removed. The final operation will be the removal of the lining of the three tunnels. This lining is double, consisting of the original lining and an inner one of reinforced concrete put in to support the old lining during excavation of the cut and built in sections so that it can be removed by cranes without interfering with traffic.

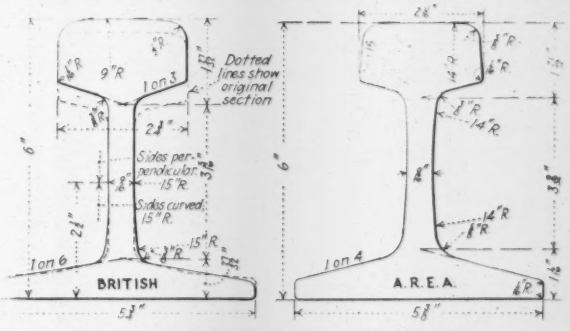
New British Standard Rail Sections

MARKED differences from American practice in rail design are embodied in the new British standards for T-rails, revised in 1924. As compared with the original section, the 100-lb. rail, shown in the accompanying drawing, has the following modifications: the height is increased $\frac{1}{4}$ in.; the top radius is

COMPARISON OF 100-LB. RAIL SECTIONS

	British		
	Original In.	New In.	Area In.
Width of base	$5\frac{1}{2}$	$5\frac{1}{2}$	$5\frac{1}{2}$
Width of head	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$
Height	$5\frac{1}{2}$	6	6
Depth of head	$1\frac{13}{16}$	$1\frac{13}{16}$	$1\frac{13}{16}$
Depth of web	3	$3\frac{3}{16}$	$3\frac{3}{16}$
Depth of base	$\frac{13}{16}$	$\frac{13}{16}$	$1\frac{1}{16}$
Sides of head	Vertical	Vertical	1 in. 16
Thickness of web	$\frac{11}{16}$	$\frac{9}{16}$	$\frac{9}{16}$
Sides of web	Vertical	Vertical and curved	Curved
Fishing surfaces; top	1 on 4	1 on 3	1 on
Fishing surfaces; bottom, 1 on 10+	1 on 4	1 on 6	1 on
Radius, top of head	12	9	14
Radius, top head corners	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{2}$
Radius, bottom head corners	$\frac{1}{16}$	$\frac{7}{32}$	$\frac{7}{32}$
Radius, top fillets	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
Radius, bottom fillets	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
Radius, sides of web	Vertical	15	14
Radius, top base corners	$\frac{1}{16}$	$\frac{1}{32}$	$\frac{1}{16}$
Radius, bottom base corners	Sharp	Sharp	$\frac{1}{16}$
Metal in head, per cent	45 19	43 56	38 2
Metal in web, per cent	18 41	21 07	22 6
Metal in base, per cent	36 40	35 37	39 2

reduced from 12 in. to 9 in., with $\frac{3}{4}$- instead of $\frac{1}{2}$-in. corners; the top corners of the base are increased from $\frac{1}{16}$ to $\frac{7}{32}$ in., the bottom corners remaining sharp, as distinguished from the $\frac{1}{16}$-in. curve of the A.R.E.A. sections. A curious feature is the new shape of the web; originally the sides were vertical, which is usual on foreign rail sections, but now they are curved to 15 in. radius from the base to center line, above which they are vertical. Another change is in the top surface of the base, which in the original section was made with a compound slope: 1 on 4 for the fishing surface and then 1 on 10 to secure sufficient thickness at the edge. So much trouble and expense were incurred in keeping the rolls dressed to this double slope that it



AMERICAN AND BRITISH 100-LB. RAILS

has been thought best to simplify the section by using a single slope of 1 on 6.

In the new section the proportion of metal in the head and base is slightly reduced, with increase in the web, but there is still a heavy preponderance of metal in the head as compared with the A.R.E.A. section.

A comparison of the old and new British sections and the A.R.E.A. section is given in the accompanying table. It is of interest to note that the new sections, prepared by the British Engineering Standards Association, are stated to have been designed with a view of suiting existing tie-plates and many types of metal ties.

Curbing a Threatened Diversion of the Missouri River

Bank Erosion with Tendency to Form Cutoff Above Glasgow, Mo., Is Checked—Permanent Protection Work Under Way

DESTRUCTION of railway and highway communications and disastrous results to a river-front city were all threatened in the recent sudden erosion of the south bank of the Missouri River near Glasgow, Mo., as noted in *Engineering News-Record* of May 15, p. 875. Views of the emergency protective work are shown in Fig. 1, and from the map, Fig. 2, it will be seen that the river threatened to cut across a narrow peninsula and thus sever the Chicago & Alton R.R. and the new federal aid highway, leaving high and dry two large bridges across the river at Glasgow. It will be noted also that at one point the south bank in 1880 was north of the present north bank, and that the locations of two old revetments of the south bank are now included in the channel.

The Missouri River makes a turn to the east at Cambridge Bend and runs closely parallel with the Chicago & Alton R.R. and the new state highway; below Harmony, however, it turns to the north and then nearly 180 deg. to the east and south, so that at Glasgow it crosses the railroad at about 90 deg. The railroad has a large bridge at that point and alongside it the Missouri State Highway Commission has a highway bridge under construction. For a number of years the river has been cutting into its south bank in the vicinity of Harmony and apparently attempting to cut across the neck of land to the river below Glasgow. Such a change would isolate the city and the present bridges and by shortening the channel it might cause increased velocity of current, which would be detrimental to navigation as the current in the present channel is already very swift. The owners of land converted into a river bed would also suffer loss of property.

Several years ago the south bank from Cambridge Bend to the turn above Glasgow was largely protected by revetment work and dikes constructed at the joint expense of the U. S. Government and the Chicago & Alton R.R. But below Harmony this revetment was not maintained in condition and during the last year or more the river has advanced rapidly towards the railroad. Early in 1924 arrangements were perfected by the railroad company, the Missouri State Highway Commission, the U. S. War Department and interested property owners to install a series of current retards built of trees, which form of bank protection has been used in a number of similar cases. There were to be eighteen of these retards from a point above Cambridge Bend to a point about ½ mile below Harmony, but later it was considered desirable to shorten some of these and to introduce two others (retards 5-A and 10-A in Fig. 2) at points where close spacing rather than length was essential.

Each retard is a permeable jetty 100 to 200 ft. in length, consisting of a mass of trees wired together

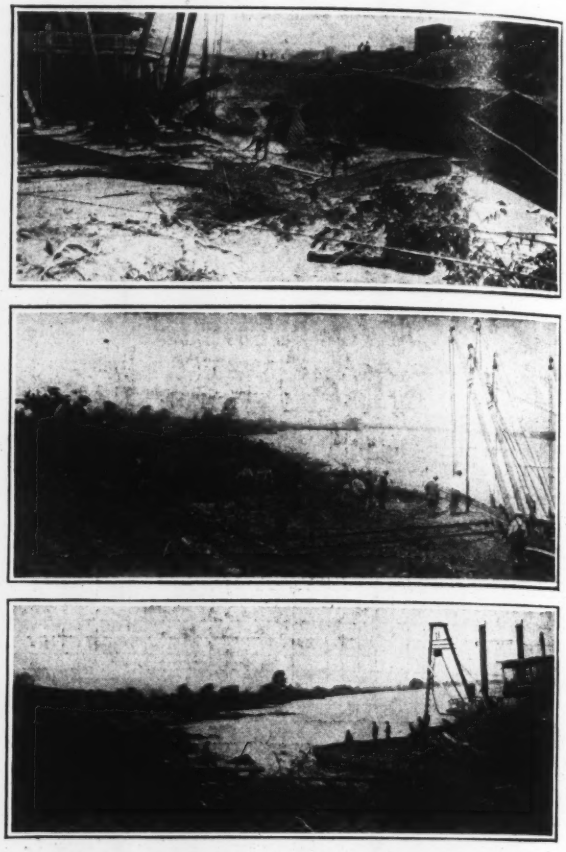


FIG. 1—EMERGENCY WORK ON BANK EROSION

Top—old steel cars being placed along toe of bank by Chicago & Alton R.R. wrecking train and U. S. snagboat "Missouri." Middle—snagboat at caving bank. Bottom—contractor's steamer building current retard with trees unloaded from barge; caving bank at left has reached railroad embankment.

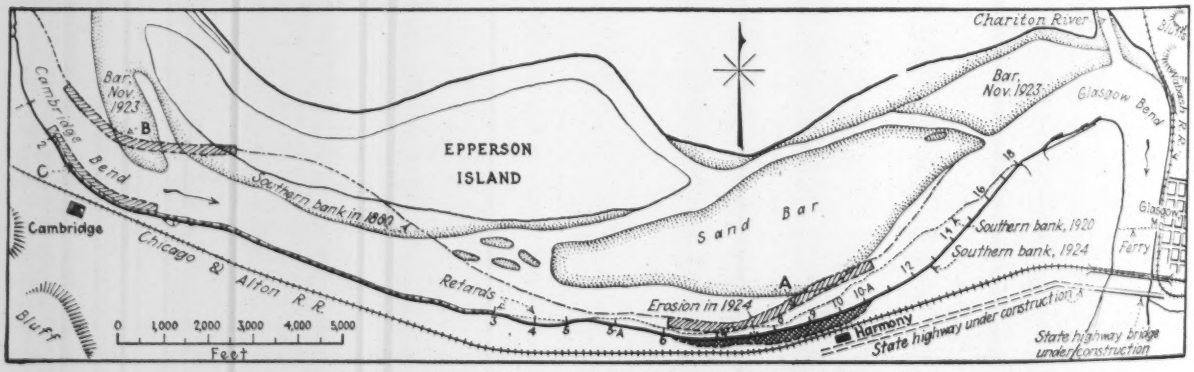


FIG. 2—MISSOURI RIVER CHANNEL ABOVE GLASGOW

A—revetment built by U. S. Government in 1880. B—revetment built in 1881. C—willow mat covered with stone, built in 1889. Retards placed between Cambridge and Harmony in 1924 to throw channel to the north.

and extending from the water surface to the bottom of the river, as shown in Fig. 4. The retards are held in place by wire cables attached to 15-ft. concrete anchor piles sunk in the river bed to a depth of 60 to 70 ft. below the water surface by means of water jets through the piles. The action of these retards is not only to deflect the current from the bank, but by checking the velocity of flow near the bank they cause large deposits of sand to be made, forming a protective beach or foreshore.

Owing to the number of interested parties, the negotiations proceeded rather slowly and the contractor did not begin work until about April 1. At that time the erosion near Harmony had advanced until the river was within 160 ft. of the railroad's main track. The river was also high for that season of the year and the main current was close to the south bank. A channel depth of about 35 ft. within 50 ft. of the shore line indicated that the current was being thrown directly against this bank, causing the erosion.

For the immediate protection of the bank while the permanent retards were being constructed and were silting up, trees were thrown into the water alongside the bank and held by wire cables anchored on shore. But although the current appeared to be considerably deflected and there was no surface current observable, the caving continued intermittently and was increased during the latter part of April by a fall of 5 or 6 ft. in the river level, leaving the bank about 15 ft. high and practically vertical. Below 4 or 5 ft. of soil the formation is principally sand. After periods of several days the bank would suddenly cave for a length of about 100 ft. and a width of 35 to 40 ft., from which it was evident that under-currents were washing away the sand so as to undermine the bank.

About May 1, in spite of the temporary protection, the erosion had advanced to the railroad company's right-of-way line, which is only 75 ft. from the main track, and it became apparent that to prevent the railroad from being cut it was necessary to provide immediate protection with the means most quickly available.

For this emergency operation a railway wrecking crane and the U. S. Government snagboat "Missouri" placed the bodies of old steel coal-cars in the water about 20 ft. from the bank; willow brush placed between the cars and the shore was weighted with sand bags and riprap stone. Only the places which were close to the track were protected in this manner, along about ¼ mile of the river. Up to May 17 this protection showed no signs of failing, although the erosion continued farther downstream, but the most advanced erosion had attacked the slope of the 10-ft. railroad embankment as indicated in Figs 1 and 5. By July 1, there had been placed 116 coal-car bodies and 385 carloads of riprap.

This emergency protection work, consisting of coal-cars, riprap and rock-filled cribbing made of old ties, undoubtedly saved the railroad from being cut in two by the action of the river, and it is felt that with the very substantial obstructions in the way of the current which these constitute, there will be no further serious danger to the tracks, although additional riprap may have to be placed from time to time as settlement

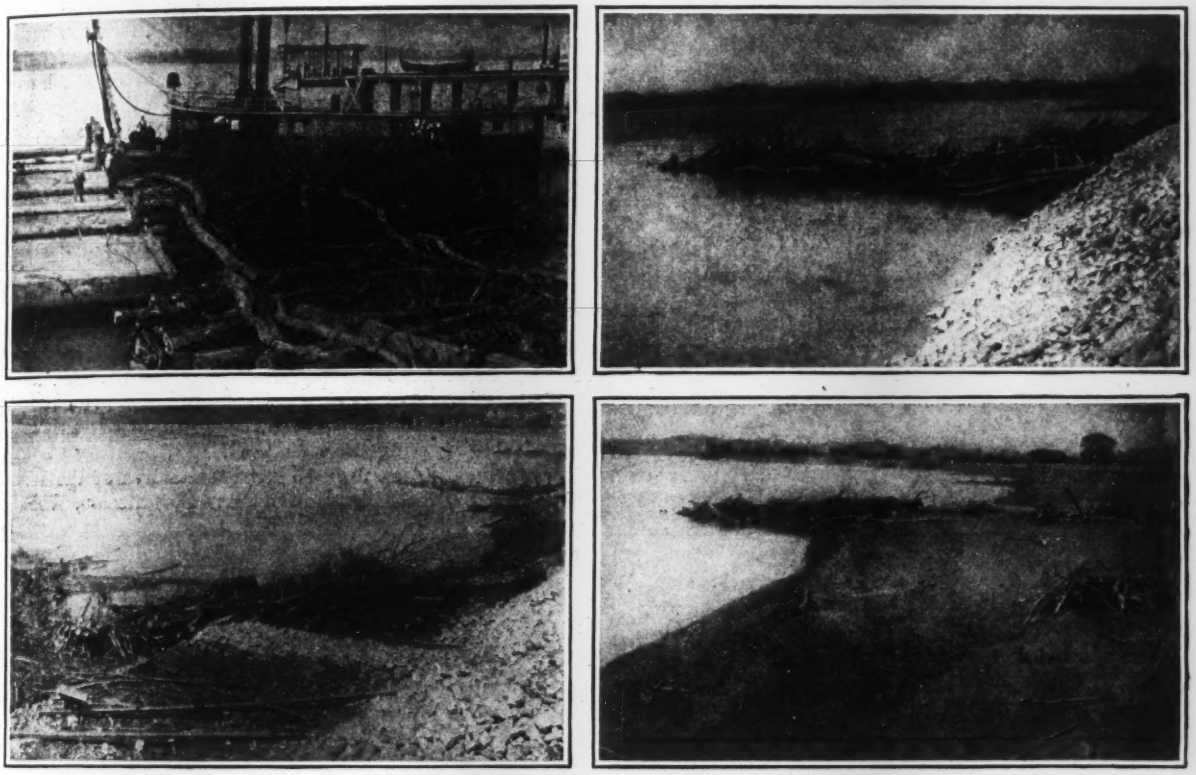


FIG. 3—CURRENT RETARDS AND THEIR EFFECTS

Top, left—contractor's steamer building retard of interlaced trees. Top, right—retards 15 to 18, showing collection of drift. Bottom, left—retards 12 to 14; deeper channel is about 200 ft. from bank; quiet water between retards shows that silting has begun. Bottom, right—foreshore built up by retards and left by falling river; willows will soon grow.

occurs in that already placed or excessive erosion occurs on either side of the present protected zone.

By the middle of July nearly all the retards were completed, as shown in Fig. 3, but the current was still hugging the south shore and the railroad officials felt that there was not a sufficient margin of safety for their line between retards 10-A and 12, where the right-of-way had been invaded, as shown by Fig. 5. In the interests of both the railway and the highway it is desirable to get the main channel on the north side of the sandbar and in that way relieve the south bank (see Fig. 2). At a conference between representatives of the War Department, the Chicago & Alton R.R. and the Missouri State Highway Department, the railroad suggested that retards 3 and 4 be built out for an additional length of 300 and 400 ft. respectively, making their total lengths 450 and 550 ft., so as to throw the current against the point of the sandbar below; it was considered that this would relieve the retards along the south bank from the heavy current and thus give silt and sand an opportunity to settle around them and in that way build out the bank. An objection offered was that the current after striking the bar might swing back and strike the bank near retards 13 and 14.

The project is a big one as it involves the diversion of the main flow of the river to a new channel and trying to make it abandon an old channel. Several methods were suggested for directing the channel to the north of the sandbar, such as dredging or dynamiting the channel or through agitation to cause scour. For this last plan it was proposed to have a river steamer travel up and down the channel on the north side of

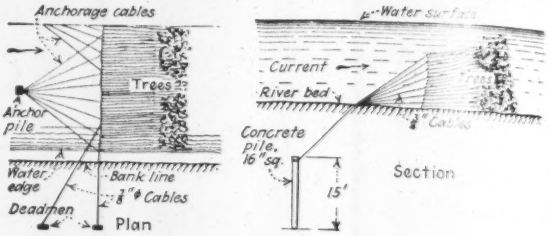


FIG. 4—TYPICAL CONSTRUCTION OF RETARDS

the sandbar, agitating the bottom so that the additional current would carry away the silt and sand thus stirred up.

Another high-water period occurred at the end of June, the water being at its highest level about July 1. At that time the water surface was approximately level with the elevation of the top of the bank and the top of the riprap protection work (Fig. 4). When at this elevation the river spreads out so that the cross-section of the channel is very greatly increased and the velocity of the flow is consequently reduced. This is the period when deposits accumulate behind the retards. At that stage of the water no trouble was experienced, as was to be expected from reduced velocity of the current.

After the high-water period, however, the river fell about 4 or 5 ft., and this fall was accompanied by some further caving of the banks between retards 13 and 14, just east of the easterly end of the riprap protection. This riprap work held very well, although there were some settlements, as had been expected. Where the coal-car bodies were placed, there has been almost no settlement. Since the water level has fallen, it is apparent that considerable deposits of silt have accumulated behind the retards, although these deposits are less pronounced in the vicinity of retards 9 to 13 inclusive and there are indications that the current is beginning to erode some of these new deposits. It is also evident that the channel to the north of the sandbar, which it is hoped will become the main channel of the river, has been enlarged considerably during this latest stage of high water; the sandbar has also been built up on the south side so that it extends much further out into the south channel than previously. In fact, by the middle of July the north channel was nearly three times as wide as the south channel, and although it was of much less depth it had water enough to float a steamboat while a rather rapid current was steadily deepening this channel.

At a meeting on July 18, representatives of the War Department, the Missouri Highway Commission, Woods

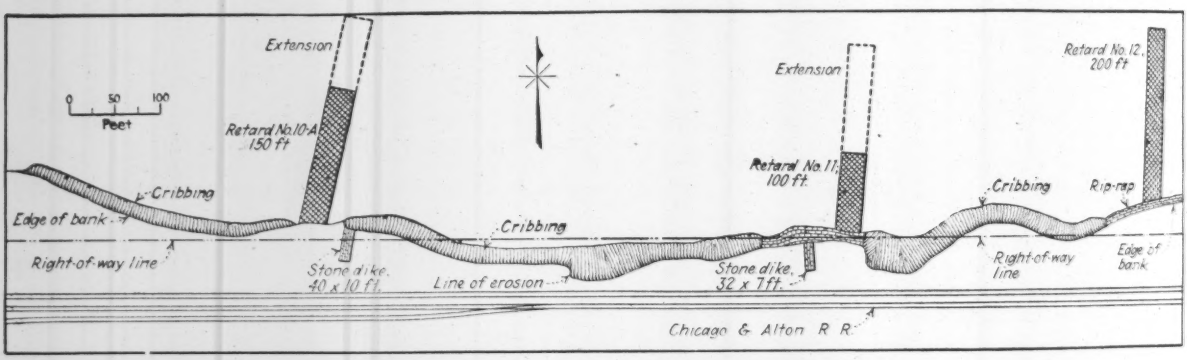


FIG.5—MISSOURI RIVER ENCROACHES ON RAILROAD

Bros. Construction Co. and the Chicago & Alton R.R. discussed additional measures, including principally the diversion of the main stream to the north channel by building out retards 3 and 4 to form a deflector, also the lengthening of retards 9 to 13 inclusive in order to push the current further away from the bank and thus reduce erosive action in that vicinity. These five retards were originally planned to be in line at the north end with those on either side, but as built to the specified length they are not thus in line, owing to the fact that the bank had eroded considerably between the time of laying out the retards and carrying out their construction.

On the basis of surveys and soundings made to determine the situation it was decided that the success of diverting the river to the north channel in this way would be very doubtful, and that the main current might merely be thrown against the sandbar, which in

turn would deflect it with greater force against the south shore, where the recent difficulties have been experienced. This conclusion was influenced strongly by the conditions at Harmony. It was decided therefore, to extend retards 9 to 13, inclusive, sufficiently to bring their north ends in line with the ends of the retards on either side, making an aggregate increase in length of about 400 ft., or a total of 3,400 ft. for the twenty retards. This will give a smooth curve from retards 8 to 14, and is expected to cause the south bank to build out considerably, leaving a margin of safety in case of future erosion. It was also decided to increase the length of retards 3 and 4 by small amounts, with the idea that possibly the action of these retards has caused the recent enlargement of the north channel. The Missouri Highway Commission, the U. S. War Department and the Chicago & Alton R.R. have agreed to participate in the cost of the additions.

These protective works have been carried out under the direct supervision of W. G. Bierd, receiver, and R. A. Cook, chief engineer, of the Chicago & Alton R.R.; B. H. Piepmeier, chief engineer, and L. J. Sverdrup, bridge engineer, of the Missouri State Highway Commission, and Major C. C. Gee, U. S. Engineers, of the Kansas City District, for the U. S. War Department. The Woods Bros. Construction Co., Lincoln, Neb., has the contract for the retards, and the work is in charge of Wayne Pringle, chief engineer of that company.

Tracer's Mistake Caused Concrete Wall Break at Sacramento

THE FAILURE of the concrete wall between the grit basin and sedimentation basin No. 3 of the filtration plant at Sacramento, Calif., which occurred on June 24 was the subject of a report recently submitted to the city authorities by Charles Gilman Hyde and George J. Calder, chief consulting engineer and resident engineer, respectively, on Sacramento's water-filtration project.

The break, according to the report, occurred when the sedimentation basin was full and the grit chamber was being dewatered for cleaning. Unbalanced pressure, exceeding the strength of the main party wall between these two basins, carried away about 80 ft. of its total length of 191 ft. and the rush of water through the break overturned the baffle or diffusion wall and in so doing took out the supports of the aerator pipe system, dropping about half the pipes into the grit basin.

By keeping both basins filled with water after the break the plant was kept in operation and there was no interruption to the city service. It has been decided that the dewatering of both basins to make repairs will not be done until this autumn when the summer season demand for water will decrease. Reconstruction of the wall, according to the report, will require about three months and will cost about $20,000.

An examination of the original plans and subsequent tracings shows that although the wall was properly designed to take unbalanced loads from either direction—i.e., with either basin full while the other was empty—an error was made by the tracer who copied the original plans in the process of making up contract drawings in that for one side of the wall he showed only 25 per cent of the amount of steel called for on the original drawing. Thus, when the grit chamber was dewatered with the sedimentation basin full the deficiency in steel on one side of the wall caused the failure that occurred.

Both the contractor and the superintendent of the plant were cleared of all responsibility for the break by the report, which states: "We are completely at a loss to explain the reason for the fact that the wall was designed correctly and then detailed incorrectly. The drawing, however, passed the inspection and scrutiny of at least five or six capable persons without discovery of the discrepancy."

The entire pumping and filtration plant, including the grit and sedimentation basins, the report stated, has been designed to give the very greatest flexibility of operation and, notwithstanding this accident, the plant is still capable of functioning properly.

Test Fence for Wood Painting Study

A TEST FENCE is being erected by the Forest Products Laboratory at Madison, Wis., to show which of the woods commonly used in outside construction will take and hold paint satisfactorily, which are difficult to paint and how painting difficulties may be overcome. Nine other test fences are being put up in the various climatic regions of the United States.

TYPICAL TEST FENCE FOR PAINT STUDY
At right—Painter getting weight of paint used

As the study undertaken is not for the purpose of comparing various paint mixtures, two paints only have been used. One of these is a Dutch process white lead in oil and the other a white lead, zinc oxide and asbestine, mixed pigment paint which is believed to be representative of a large amount of the high-grade "ready mixed" paints on the market. A flat-grain panel and an edge-grain panel of each kind of wood are coated with each kind of paint. Three coats of the paints are applied. The row of tilted panels at the top of the fence is for the purpose of comparing weathering of paint on an inclined surface with weathering on the vertical surfaces. Horizontal drain strips between panels serve to keep the pigment of the upper panels from washing across the lower ones.

After each coat of paint is applied to a panel, the painter weighs paint, can and brush to determine the amount of paint required to coat the various woods.

Paint and varnish and lumber associations, the Bureau of Standards and private interests are cooperating with the Forest Products Laboratory in the painting study. (See *Engineering News-Record*, May 1, 1924, p. 759.)

One of a Series of Articles on the Details of Design and Layout of Different Types of Industrial Buildings

River Rouge Automobile Plate Glass Factory

Solid Walls and Roof of Steel Sash and Wire Glass Dictated by Lighting and Ventilation Requirements—Conveyors Make Operations Mechanical

BY J. WILSON ROBINSON
Everett Winters Co., General Builders, Detroit, Mich.

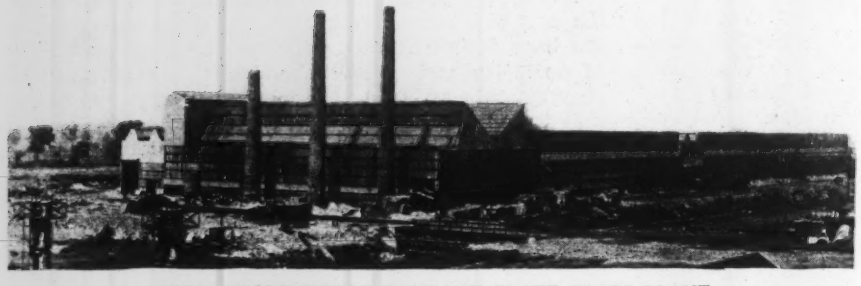


FIG. 1—FORD MOTOR COMPANY PLATE GLASS PLANT
The trainshed is at the extreme left. The four chimneys face the furnace room with transverse trusses. Walls and roof are all of glass.

LIGHTING and ventilation were the controlling factors in the design of the building and type of construction to house the glass works recently constructed for the Ford Motor Co., at the River Rouge plant. This mammoth plant, having an annual capacity of 10,000,000 sq.ft. of automobile glass, is in keeping with the policy of the company to make it independent of other manufacturers. By complicated conveyor systems practically every phase of the industry is reduced to mechanical operations, from the handling of the raw materials as they enter the plant to the final washing and drying of the finished glass. Furnace construction, lehrs, or annealing tunnels, grinders and polishers are all of the most modern design and laid out so that the materials will flow through the plant largely in parallel straight lines for each of the four units in the least time and with the greatest efficiency.

Located close to the motor assembly and spring and upset building where a portion of the products are used, the 760 x 241-ft. one-story building is served by the Detroit, Toledo & Ironton R.R. and the River Rouge.

Lighting and Ventilation—The building is of steel construction with cement tile roof and steel sash sidewalls and monitors. The roof formation is a series of Pond trusses and A-frames. The building is divided into three major parts, the furnace room, main factory portion and trainshed.

The furnace room, being the source of the greatest number of heat units, is covered with a Pond truss running crosswise of the building over the four furnaces. This type of roof is so formed that all heat currents are carried by the shortest route to large outlets and at the same time the interior is lighted with equal effectiveness. The main factory roof consists of two parallel Pond trusses hung with continuous sash, alternating with two A-frames, intersected by two parallel A-frames running cross-wise of the building at the center and over the balcony. The four lehrs, which are the heat producing operations in the main factory portion, are located directly under the high points of the Pond trusses. The roof over the trainshed consists of two parallel A-frames hung with continuous sash.

The sidewalls, with the exception of the west wall of the trainshed, are filled with continuous top-hung sash outside the structural work. This arrangement coupled with the A-frames gives the necessary inlet areas for fresh air and provides weather protection.

The continuous runs of sash throughout the building are motor operated and mass controlled at a central point by the Pond operating device, the sash being balanced by spirals and counterweights. The mass con-

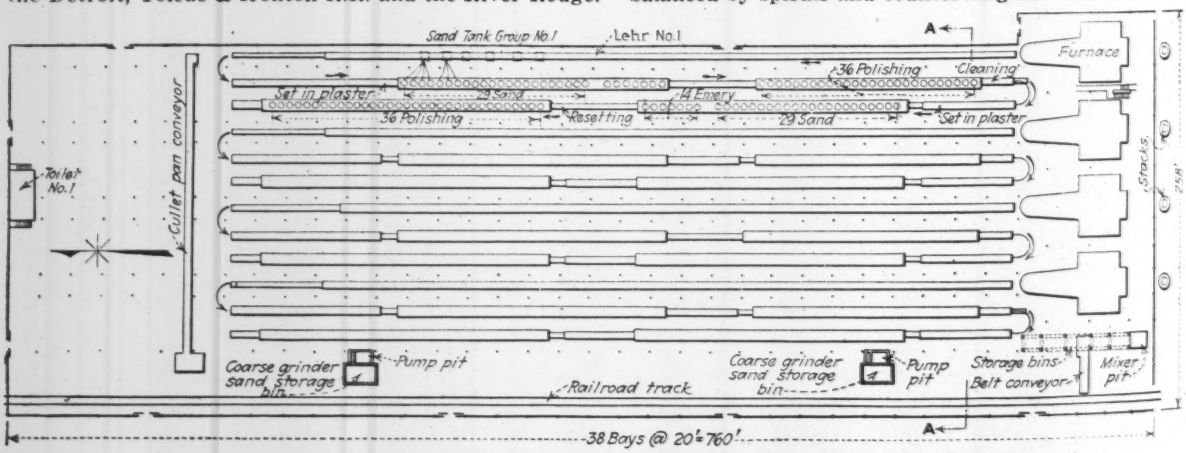


FIG. 2—PLANT LAYOUT SHOWING TRAINSHED, FURNACE ROOM AND FACTORY
Glass travels 1,560 ft. in 9 hours from furnaces at right to washing machines after final polishing under thirty-six polishing heads and passing length of factory three times

trol, placing the ventilation in the hands of the superintendent, gives a slow and general movement of air throughout the entire building. The building is glazed throughout with ¼-in. wire glass, lights ranging from 3 ft. to 6 ft. in height and 2 ft. in width.

Furnaces—The tank furnaces are built up of large blocks of fire clay bound together by a complicated system of tierods and buck stays and are supported on a series of concrete piers and steel girders 15 ft. above the basement floor level. On either side of the furnaces are four brick-stacked chambers or regenerators built up with checkered brick, the sides of which are insulated with cork brick. These chambers come up and form port-holes 3½ x 2 ft. in the sides of the furnace at a point 6 ft. above the furnace floor. The sixteen flame nozzles which heat the furnace enter at these port-holes, two at each hole. The temperature of the outer walls of the furnaces is reduced by a system of cold air blasts applied along the full length of the furnaces at floor level and up to a height of about 3 feet.

In an ordinary furnace a very large part of the heat of combustion is lost by being carried off in the hot gases which pass up the chimney. In these furnaces the hot gases pass through the series of regenerators on one side of the furnace. These chambers or regenerators are stacked with checkered brick which absorb the heat. When the bricks are well heated the hot gases are diverted to pass down through the regenerators on the other side of the furnace. The air necessary for combustion before it enters the furnace is made to traverse the heated chambers, and, taking up as it goes the heat which has been stored in the bricks entering the furnace at the port-holes, combines with the gas flames to give a combustion efficiency not otherwise attainable. After a suitable interval the air currents and gas flames are reversed. The generative furnace was first applied at Chance's Glass Works in Birmingham, England, in 1861 but it was several years after this before it was a success.

In a great many respects the gas melting tank resembles the open-hearth steel furnace though it differs considerably in size due to the relatively low density of glass. The molten glass is drawn off by a method similar to the one used in drawing off fluid steel from the open-hearth steel furnace. The temperature required in the fusion of the glass is much lower than that attained in steel furnaces. It is therefore possible to work glass tank furnaces continuously for many months. The temperature of these furnaces is graduated from 2,450 deg. F. at the charging end to 2,150 deg. at the discharging end.

Heretofore the largest successfully operated glass tank furnaces held about 150 tons of material. These furnaces, which are 16 ft. wide, 78 ft. long and 11 ft. deep, inside dimensions, hold about 250 tons of materials.

Following the material through the plant in the various processes will give the best understanding of the complications in the conveyor and handling systems employed.

FIG. 4—GRINDING AND POLISHING UNIT SET ON A SINGLE HEAVY FOUNDATION

Plaster setting tables and first three sand grinding heads showing pipes leading from sand tanks over lehrs in the background. Rouge tanks are located between each of the polishing units in the foreground. With the exception of motors, this machinery is made up of standard Ford parts.

Raw Materials—From the railroad cars in the trainshed are unloaded the raw materials which go to make up the finished products. The raw material storage bins of hopper-bottom construction are located between furnace 4 and the trainshed. These bins of reinforced-concrete construction are 80 ft. long, 18 ft. wide and 36 ft. high supported on reinforced-concrete columns, 11 ft. above factory floor level. The raw materials, namely, sand, soda ash, limestone and salt cake are conveyed from the railroad cars to the storage bins by means of a belt conveyor under the factory floor level to a bucket elevator which carries the raw material up to the distributing room over the bins. Here the material is dumped into a belt conveyor which is adjusted over the respective bins, according to the material being unloaded.

Underneath the storage bins at factory floor level is an electrically operated weighing car and hopper into which the raw materials are dumped and weighed. Below the factory floor level is the batch mixer which is charged from the weighing car by gravity. After the batch is thoroughly mixed it is discharged onto a belt conveyor which conveys it to a bucket elevator just south of the storage bins. The bucket elevator carries the batch up to a point above the charging floor level

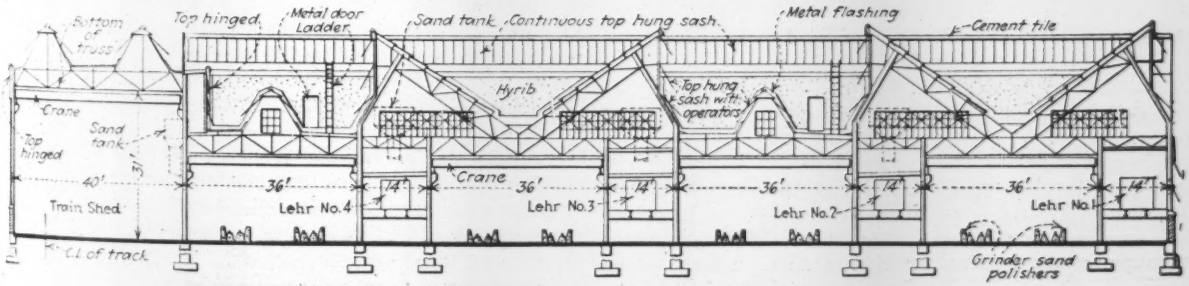


FIG. 3—CROSS-SECTION SHOWS LEHR FRAMING, GRINDER FOUNDATIONS AND TRUSS DESIGN

The source of the greatest number of heat units, the lehrs, are located under the high points of the Pond trusses to give greatest elimination of heat.

where it is discharged into an electrically operated distributing car which runs east and west on the charging floor and about 15 ft. south of the furnaces. This car distributes the raw materials to the respective furnace bins under the charging floor. The batch is discharged from the bottom of the distributing car through the floor to the bin. From there, by means of a bucket elevator the batch is conveyed up to and discharged into the furnace-charging hopper located about 20 ft. above the charging floor. The furnace is charged from this hopper as required from time to time. The average charge weighs 852 lb.

Lehrs—As the molten glass is drawn from the furnace it passes through a set of steel rollers which roll it to a width of 20½ in.; it then passes onto a conveyor which carries it through the lehr (see Fig. 5). The lehr, or annealing tunnel 520 ft. in length, takes the continuous sheet of molten glass as it comes through the rollers and gradually cools it as it passes through the tunnel, traveling with sufficient rapidity to prevent the formation of visible crystals. The temperature of the lehr is controlled by gas jets. About 3 hours are required from the time the molten mass leaves the furnace until it is discharged from the lehr at the other end in the form of sheets of cool glass 1 ft. 8½ in. wide by 9½ ft. long, known as rough glass.

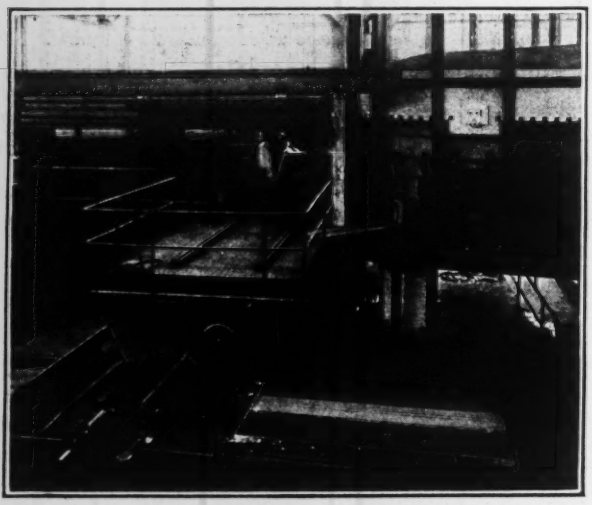


FIG. 5—DISCHARGE END OF FURNACE POURING GLASS INTO ROLLING TABLE AND ENTERING LEHR
Blower pipes along sides of furnace reduce temperature of exterior sides of furnace. In foreground is table of semi-finished glass in carrier ready for return trip.

Grinders and Polishers—As the sheets of rough glass are discharged from the north end of the lehr they are placed on tables 3 ft. 7 in. wide and 9½ ft. long and set in plaster, two sheets to a table. One of these tables is shown in the foreground of Fig. 4. This glass is now ready for the grinders.

Starting at this end, the tables, traveling south at the rate of 35 in. per minute, pass under twenty-nine rotary grinding machines, each alternate machine revolving in opposite direction and driven by individual motors. As the glass passes under the grinders, sand and water, graded from No. 1 for the first seven grinders to No. 8 for the last two, is fed to the grinders through tubes leading from the sand tanks located above the lehrs. The sand tanks are charged from the concrete sand-storage bins located in the trainshed. The sand is automatically washed from the glass, while the tables are moving, by means of nozzles playing water on the glass from both sides of the grinders. Through a system of trenches in the concrete foundations this waste sand and water is collected in a pit and from there pumped back up into the sand tanks and re-used.

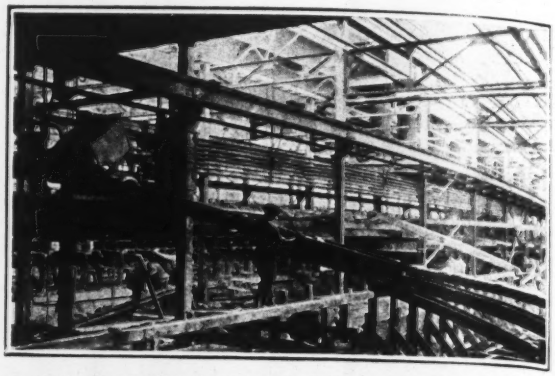


FIG. 6—CHUTING CONCRETE FROM TRUCTRACTOR ON LEHR RUNWAY FOR POLISHING UNIT FOUNDATIONS

The glass next passes under fourteen emery grinding machines. Here seven different grades of emery are used, to smooth the surface of the glass and prepare it for the polishing machines. As the glass passes from under the last emery machine it is again automatically washed, inspected, all defects repaired and again washed.

The polishing process is carried out in a manner similar to the grinding by thirty-six polishing machines equipped with felt pads. In this case rouge is used for polishing and giving the glass the final finish. In Fig. 5 can be seen the rouge tanks, one located between each set of polishing machines in the foreground.

The glass, which is now called semi-finished, is stripped from the tables, the tables are cleaned and the semi-finished glass is relaid in plaster with the finish side down. The table is then pushed onto a carrier as shown in the foreground, Fig. 5, which travels in a semicircle to the next line of grinders and travels back from the direction it came, going through the same process. Upon reaching the end of the polishers the glass passes through a washing machine which mechanically washes and dries it. It is then cut in the various sizes as required. From the state of molten glass to the finished product it has traveled about 1,560 ft. in approximately 9 hours, this period varying according to the speed of travel which averages about 3 ft. per minute.

Extending across the building just north of the polishing units is a pan conveyor below floor level that conveys all the breakage, or cullet as it is called, to a point on the west side of the building where it is elevated by a vertical bucket conveyor to a point overhead and from there conveyed back to the storage bins adjoining furnace 4.

Construction—For several reasons it was necessary to divide the excavation and concrete work into two major operations. On account of the time limit it became necessary to put in all column footings first, so that the structural steel could be erected and the building closed in as soon as possible.

Following the erection of the structural steel, deposition of the concrete for grinder foundations, of which there were four units of two rows each was the next

step. The building was constructed on hydraulic filled ground and certain parts of it had been used as a dumping ground during war construction work. The excavation work was made more difficult on account of piles, railroad ties, etc., encountered in the dumping-ground sections. At each supporting center of the grinder foundations the design called for two separate reinforced-concrete wall footings. Footing depths, depending upon soil values, ran from 3 ft. to 19 ft. 8 in. It was therefore necessary to use shoring on practically all of the foundations. Conditions were such that it was impossible to move the dragline to the next location until the shoring was completed.

runway was constructed, ramping up to the structural X-framing, for supporting lehr 4 at a point 6 ft. above floor level and from there on across the building to lehr 2. A runway was then made at this 6-ft. level the full length of the lehrs. The wet concrete was distributed from the mixing plant in tructractors to the forms.

For the purpose of carrying off the waste grinding material and water the grinder foundations contained three gutters formed in the concrete running the full length of the foundations. These gutters varied from 3 in. to 4½ ft. in depth and from 3 in. to 15 in. in width. In all, there were over 12,480 lin.ft. of gutters to form.

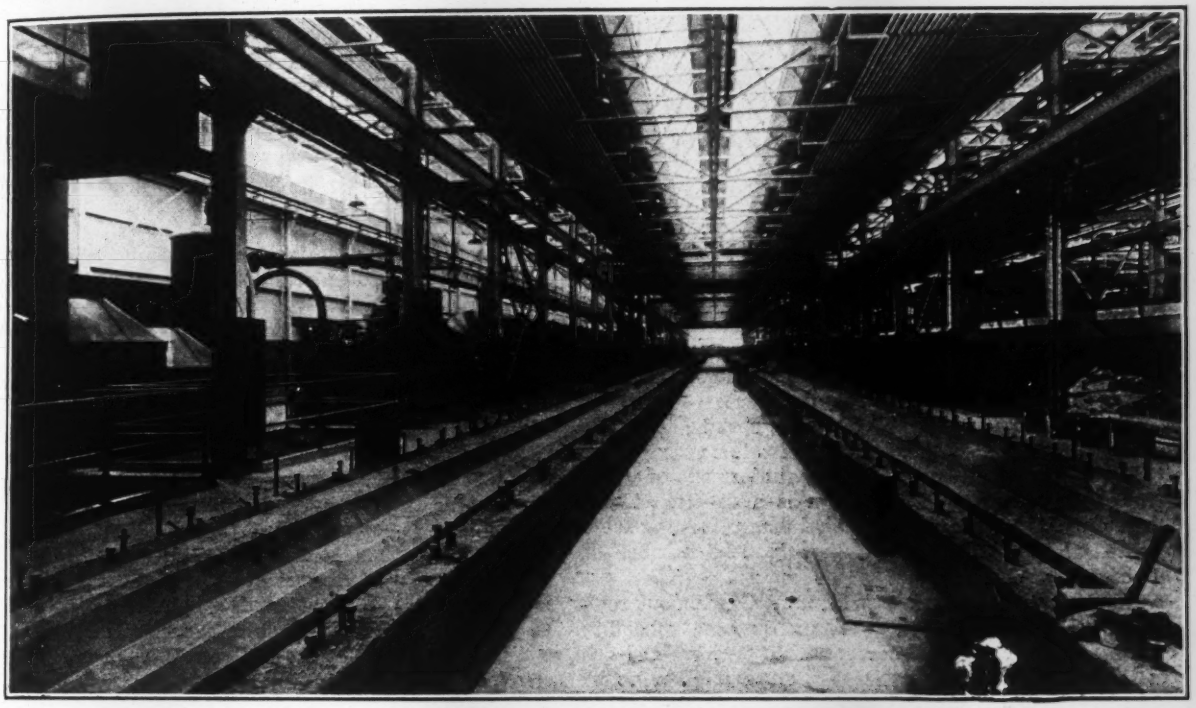


FIG. 7—CONTINUOUS FOUNDATIONS READY FOR INSTALLING GRINDING (LEFT) AND POLISHING MACHINES (RIGHT)
At the left foreground are the reinforced-concrete coarse grinding sand-storage bin and pump pit.

It was originally intended to carry out this excavation work by the usual hand method but due to unusual conditions which could not be anticipated it was necessary to devise some other economical method of making this excavation. After considerable study the following method was developed and put into operation by the writer. A ¾-yd. dragline outfit with crawler traction was rigged up with a short shovel boom attachment and an orangepeel bucket with a heavy ball weight. This outfit, which worked on the principle of a post-hole digger, though working in limited celarances was satisfactory. The trusses and columns limited the area under which the shovel could work, even with a short boom. The drawing shows a clearance to the bottom chord of trusses of 18 ft. and a distance from center to center of columns of 36 ft.

Due to column spacing and other limiting clearances, it was impossible to operate a concrete mixing and distributing plant in the building for handling the concrete for the grinders. This difficulty was overcome by taking advantage of the lehr framing in the 14-ft. bays. The mixing plant was set up just outside the trainshed at the south end of the building and from there a

To take care of these varying depths and widths standard form panels were made up of 18-gage galvanized iron. These metal forms were oiled and supported in the foundation forms until the concrete was poured. As soon as the concrete had its initial set the collapsible bracing was removed and the forms pulled for future use.

The building was designed by Albert Kahn as architect and the Ford Motor Co. engineering department. The general contractor was the Everett Winters Co., Detroit, Michigan.

Communication Between Tripoli and Tunisia

The Italian minister of colonies has made public that discussion is being carried on with the French colonial office for the construction by the nations jointly interested of a railway which will connect Tripoli in Barbary and neighboring Tunis. The project if, and when, carried out will put into development a vast area of fertile country which for the present is accessible only by camel caravan and has remained to the present time virtually unexploited.

Notes from Foreign Fields

Engineers and Their Societies in Britain

By E. J. Mehren
Vice-President, McGraw-Hill Co., Inc.

THERE IS a fine fellowship among engineers. No matter from what corner of the world they come the professional kinship is a sufficient introduction. I have seen this demonstrated time and again in my travels—in every nook and corner of the United States, in Canada, in Europe. I have seen it most strikingly in the office of *Engineering News-Record,* whither come engineers from every quarter of the globe, feeling assured that even without introduction they will be given every assistance possible because they come as engineers to engineers.

On this trip, too, it has been demonstrated. There have been more offers of assistance than could be accepted. There has been free interchange of views on engineering problems, on the condition of engineers, and the activities of engineering societies.

Some things I have learned about the welfare of engineers and their societies may interest the readers of *Engineering News-Record*—such as the status of engineering employment, the formation of the Engineering Joint Council, and the establishment, legally, of the title, "chartered civil engineer."

Employment—As to employment, it may be said that among experienced civil engineers there is no very great distress. There are, however, many juniors out of work. This is not surprising, for there is a dearth of new large projects, and the colleges and men returning from overseas have considerably augmented the number of engineers available.

There was in England, as with us, a tremendous rush to the colleges after the war, men whose schooling had been interrupted or deferred. They were fed out in the three subsequent years—a large number to be absorbed into professional ranks. Latterly, too, many British engineers have been returning from India, and have been replaced not by other Englishmen but by natives. Again, since Egypt's sovereignty was established fewer British engineers are entering upon work in that country.

These conditions work to the disadvantage of the juniors. The older men naturally keep their places or are given preference in transfers, while men returning home, being experienced, necessarily are preferred to the juniors.

Nevertheless, conditions are improving and the expected beginning of several large projects long under discussion is looked on as a favorable sign.

Joint Engineering Council—Americans will be interested, too, in the efforts here to bring into helpful co-operation the major engineering societies. A co-operative committee known as the Engineering Joint Council was formed in 1922. It is advisory rather than administrative, and differs, therefore, from our Federated American Engineering Societies. It is similar, however, to the joint committee of our four large national societies recently resurrected. The constitution specifically says regarding the powers of the Joint Council that it shall consider matters referred to it by the councils of the constituent Institutions, and that "it shall not initiate proposals affecting the Institutions, and shall be an advisory body without executive powers."

There are four "founder" societies, the Institutions of Civil, Mechanical, and Electrical Engineers, and of Naval Architects. Each society appoints two members to the Joint Council. Provision is made for the admission of other institutions and societies, under the style of "constituent institutions," these to have one member in the Council. The Institution of Municipal and County Engineers has been admitted into this classification.

A number of matters are in hand in the Council, but as yet it is too early to speak of results. It may be said, however, that the projects include thorough planning for the conduct and co-ordination of a broad program of engineering research.

"Chartered Civil Engineer"—When I was in England in 1920 a project was under discussion for safeguarding engineering practice by restricting the use of the title "civil engineer." Its general object was similar to that of our licensing laws. It was hoped to establish by law qualifications and examinations for those who wished to use that title. Considerable difficulty was experienced, however, in pushing the bill, and the project was dropped.

Since then another solution has been found and is now effective. Under this plan the Institution of Civil Engineering and the Institution of Electrical Engineers have had reserved to their members, respectively, the titles, "chartered civil engineer" and "chartered electrical engineer." This was accomplished by securing changes in their charters, a procedure not requiring Parliamentary sanction, but falling directly under the King, acting through the Privy Council.

Under the new charter every member and associate member of the Institution of Civil Engineers, during the term of his membership, may designate himself a "chartered civil engineer," and no others may use the title. Prosecution will follow unauthorized use.

The effect is not restrictive of practice, as are our licensing laws. No one is stopped from practising the profession of civil engineering, but no one, unless he is a member or an associate member of the Institution, may use the restricted title. The protection to the public must come from the effect of the prestige and efforts of the Institution in convincing the public that civil engineering work is safely entrusted only to a "chartered civil engineer." Obviously, the word "chartered" in the title has a very considerable value in that it indicates a legal status of the title—this by contrast to the title "civil engineer" which it was hoped to restrict under the earlier proposal.

The advantages to the public, as against a licensing law, are obvious. There is no stamping, in the first application of the law, of a group of inferior practitioners with the same title as is given the most eminent men of the profession, while the legal requirements for entry to the profession are not so directly affected by public opinion. Under the English plan the designated title can be made to represent what the ablest members of the profession consider the qualifications necessary to the competent performance of engineering work.

It does not, of course, protect the public against the quack. He may practice under the style "engineer" or even "civil engineer," but if the public will exercise

reasonable intelligence it now has a means of assuring itself competent service.

The Institution's prestige is, obviously, much increased. By inference, the government has constituted it arbiter of what is competence in civil engineering.

So much for the charter provision. In the by-laws of the Institution applying the charter provision, there is covered a supplemental matter that involves a point strongly debated in New York State—the licensing or recognition of corporations for the practice of engineering. The paragraph is worth quoting in full:

"A member or associate member practicing (1) under the title of, or as an officer or employee of, a limited company authorized to carry on the business of a civil engineer in all or any of its branches, or (2) in partnership with any person who is not a member or associate member of the Institution under the title of a firm, shall not use or permit to be used after the title of such company or firm the designation Chartered Civil Engineer or Chartered Civil Engineers, or describe or permit the description of such company or firm in any way as Chartered Civil Engineers."

The conclusion in England is the same as that reached in New York: A corporation may practice engineering but the restricted title in England, as in the license in New York, is reserved to the individual.

DR. H. H. JEFFCOTT

The Institution's Secretary—Since I was here in 1920, the Institution has had a new secretary. The former executive was Dr. Tudsbery, who had occupied the position for twenty-six years. He retired in 1922.

The new secretary is Dr. H. H. Jeffcott, an able, active man of possibly forty-five years, who, in his rather quick actions and manners, suggests that he might at some time have been under the influence of the rushing business life of Chicago or New York. His graduation from Dublin University with both arts and science degrees, was followed by shop work in both mechanical and electrical lines. In 1905 he entered the National Physical Laboratory as head of the Metrology Department. Five years later he was made professor of engineering in the Royal College of Science for Ireland, becoming dean of the faculty in 1914. That position he held until he took up the work of the Institution. During his years of practice he developed and patented a number of new engineering devices—in motors, electrical generators, and thrust bearings—and also wrote extensively on engineering problems on which he was engaged.

He thus comes well prepared for his present work—with a broad engineering experience, with a fine record in research, with sound educational ideas born of his years of teaching, with experience as an executive, with a sympathy, developed through his own writing, with one of the large purposes of the Institution—to draw out and record important advances in the art and science of engineering. To these technical and administrative qualifications he adds an attractive personality and thorough British courtesy and tact.

One might expect him with this personal equipment to handle his responsibilities well—and so, I was told by a number of members, he does. He runs the machinery well. He is steadfast in holding to the ideals of the great Institution.

Fellowship—In the opening paragraph of this letter, I referred to the fine fellowship that exists among engineers. Let me close with just one of the many instances of how, on this trip, it has been translated into pleasant and into helpful courtesies. At the Conversazione given by the engineering institutions, Sir Maurice Fitzmaurice, to whose courtesies I was indebted on my previous trip, introduced me to Sir Murdoch MacDonald, an engineer, and now a member of Parliament representing Inverness. In the course of conversation I inquired whether the House of Commons would sit in the following week. The reply was instant, "Yes, it will. Would you like to come to a session?" I had wanted to go, but knowing the scarcity of tickets for the galleries due to the crush of visitors to the Wembley Exhibition and the American advertising and bar conventions I had despaired of being able to go. But Sir Murdoch invited me on the strength of professional fellowship and Sir Maurice's introduction. A few days later I sat in the gallery listening to the debate on the housing bill, and afterwards, at tea on the Terrace, Sir Murdoch gave me some interesting points on the present political and social conditions in Great Britain.

We, in America, have this same feeling of engineering kinship—and, I am happy to say, do, so the British engineers firmly insist, translate it into helpful courtesies when they visit us.

London, July 21, 1924.

Warship Passes Panama Locks with Less Than a Yard Clearance

WITH a clearance of 28¾ in. on either side the British warship *Hood* July 23 and 24 safely passed through the Panama Canal without difficulty. The *Hood*, and the *Repulse*, which followed, both broke records for size of ships making the passage. Tolls collected, which are 50c. per ton of displacement, also were the record in amount, $22,339.50 for the *Hood* and $17,679.50 for the *Repulse*. The draft was 32 and 30 ft., respectively. Only 70-ft. clearance was left in the 1,000-ft. locks fore and aft of the *Hood* to the lock gates.

On account of the belts of armor, the greatest beam of the ships was below the water line. Outriggers, consisting of poles attached vertically to booms, were placed on either side, to indicate to the pilot the full beam of the ship, and seamen were stationed opposite the outriggers, with signal flags to signal to the pilot if the vessel should approach closer to the wall than 2 ft. Eight towing locomotives were used, four on either side.

On arrival the *Hood* and *Repulse* started through the canal, proceeding as far as the Gaillard Cut on the first day. The *Hood* tied up alongside the upper approach wall of Pedro Miguel Lock on the east side, and the *Repulse* was held in the east chamber of Pedro Miguel Lock, aft of the *Hood*. Both vessels spent the night at Pedro Miguel and made an early start the following morning to complete transit.—*Panama Canal Record.*

Drainage Construction on Newlands Reclamation Project

Serious Waterlogging of Farm Lands by Irrigation Seepage Water Necessitated Rapid Construction of a Comprehensive Drainage System—Over 150 Miles of Drain Built at Low Cost—Beneficial Effects

By A. W. Walker
Engineer, U. S. Bureau of Reclamation, Denver

RAPID AND economical construction of an extensive drainage system was carried out on the Newlands reclamation project in Nevada during the past three years. The conditions under which this work was done and the methods adopted in order to obtain greatest economy and speed are summarized in the following. Some data on the effect of the drainage system in lowering the ground water and in removing salt from the alkali soil are added.

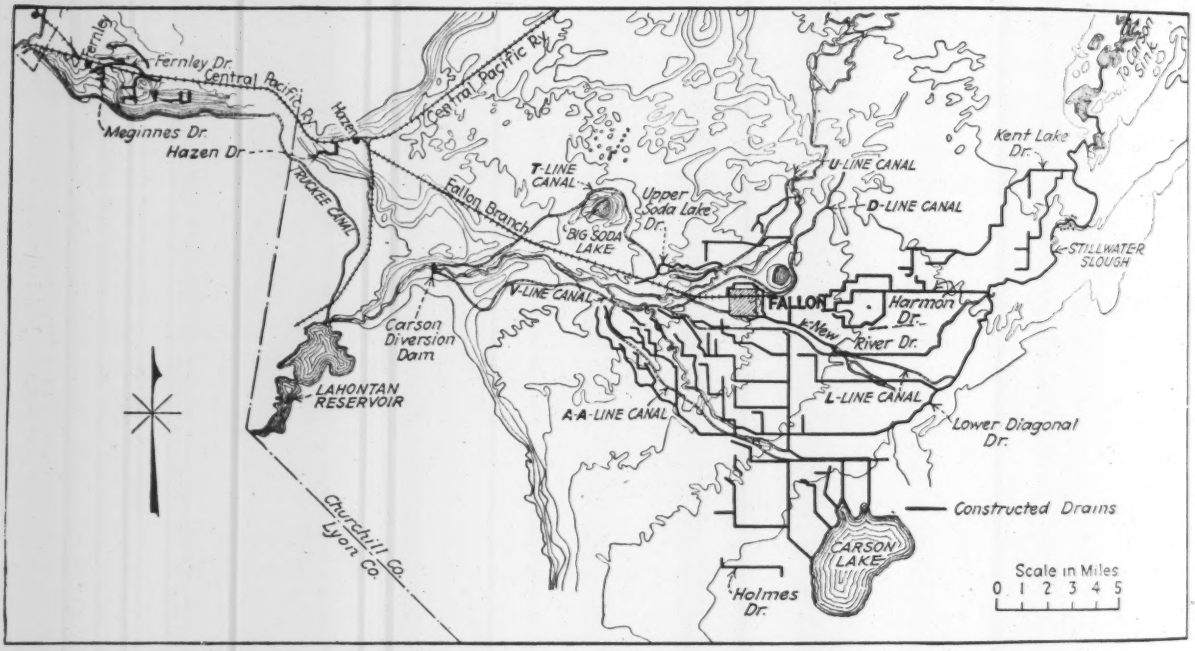


FIG. 1—DRAINAGE PLAN OF NEWLANDS PROJECT

Locality and Irrigation System—The Newlands project lies wholly within the prehistoric Lahontan Lake basin, in Nevada, the complement of Lake Bonneville in Utah. Lake Lahontan, covering about 8,400 square miles and in the deepest part about 900 ft. deep, apparently never overflowed to the ocean. Geological evidence indicates that the lake varied in size with the climate and at least twice evaporated to practically nothing. However, the present lakes of the basin are of recent age and are nearly fresh; the salts deposited when the Quaternary lake evaporated were buried or absorbed by the clays and marl.

The soils of the project, having been laid down under lacustrine conditions modified by the deltaic formation, vary from light, sandy soils, easily transported by wind, to heavy, sticky clay. The lighter and more porous soils occur generally in the upper portions of the project and in the vicinity of the old water channels. This feature makes for high seepage losses and poor natural drainage. The soils are also extremely spotted in character and are considered more or less alkaline and refractory in nature. Sodium salts predominate. The worst alkaline areas have been excluded from the irrigable lands of the district. On the lands now under water-right contract experience has shown that once these lands are subdued by good farming methods coupled with deep drainage they produce well.

Irrigation is provided by storage of water in Lake Tahoe (Truckee River basin) and in Lahontan Reservoir (Carson River basin); diversion of water from the Truckee River by a diversion dam about 20 miles below Reno, Nev., into the Truckee Canal, supplying water to lands in both the Truckee and Carson River valleys and to Lahontan Reservoir; and diversion of water from the Carson River 5 miles below Lahontan Reservoir into the T and V Canal systems, watering lands in the lower Carson basin in the vicinity of Fallon. About 70,000 acres are now under water-right contract.

Disposal of drainage waters from the irrigated lands is mostly by evaporation in the Carson Sink, a large sump-like area north and east of Fallon. Carson Lake, in the southeast portion of the project, furnishes an outlet for the immediately adjacent marginal lands. Bench lands (about 10 per cent of the area) dispose of their drainage water on adjacent alkali flats.

The main part of the area consists of lands located on the delta of Carson River, which enters the project from the west and then divides into several channels; one of these extends southeasterly into Carson Lake, another extends easterly into Stillwater Slough which

in turn flows northeasterly into the Carson Sink, while the third extends northeasterly into the Carson Sink.

Carson Lake is located about 24 miles south of Carson Sink and there is a fall of approximately 34 ft. from the bottom of Carson Lake to the outlet of Stillwater

FIG. 2—LARGE DRAIN WITH FLUME AND BRIDGE

Slough, which connects Carson Lake with Carson Sink and is the natural drainage channel of the region. Like the larger Carson Sink to the northward, it is a playa lake, formed by a very shallow depression in the lake beds flooring the desert. In 1882 its area was about 40 square miles and its depth about 4 ft. Its waters contain 1.4725 g. of solids in solution to the liter. The lake is supplied almost entirely by Carson River and originally overflowed through a slough into North Carson Lake (Carson Sink). In 1881 a meander line was established around Carson Lake at El. 3,916, the bottom of the lake being at El. 3,909. The 1923 water surface elevation at the north edge of the lake is about El. 3,911, and there is no overflow from Carson Lake to Carson Sink; a profile along the course of Stillwater Slough shows a summit in the bottom of the slough near the junction with New River, produced no doubt by material carried into the slough subsequent to the last bifurcation of the river channel in 1869.

The topography of the project lands shows a series of pot holes or depressions separated by ridges. Surface and subsurface drainage are therefore deficient. The slope of the country is flat, averaging only about 4 ft. to the mile in most of the drains. It is necessary to tap each sump-like area to provide relief. The bench lands have considerable natural drainage, but even this has to be supplemented by artificial means. While the soils are deep and the soil reservoir large, once this reservoir is filled up it does not drain readily.

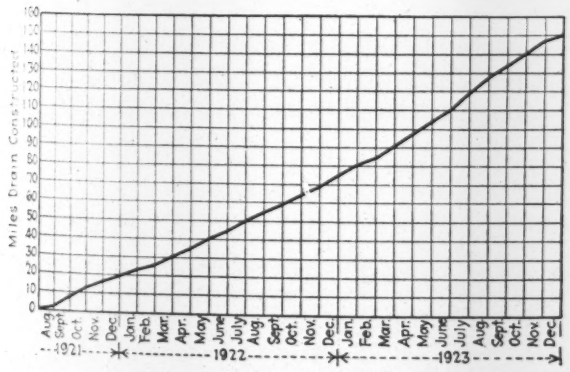


FIG. 3—PROGRESS DIAGRAM OF DRAIN CONSTRUCTION

Water Data—The annual precipitation, ten-year average, is 4.38 in., while the evaporation is 6.5 in., or nearly fifteen times the precipitation. The net evaporation, after allowing for precipitation, is over 61 in. per year. The evaporation occurs during the irrigation season; for the four months, May to August inclusive, the monthly evaporation is nearly 10 in.

Table I shows the amount of water delivered to the farms on the different divisions of the project and from 1918 to 1923 shows water losses. In studying this table the shoestring character of the project should be borne in mind. The irrigable lands are more or less scattered. New lands require a large quantity of water, and canals and laterals built through lands of a more or less sandy nature which have been desert for centuries will show large losses. On all the divisions it is evident that the water delivered to the farms is more than the growing plants require.

The main conclusion to be drawn from this table is the fact that large quantities of water are entering the subsoil from direct irrigation and losses from the canal and lateral systems. It is also evident that when the natural drainage becomes overloaded, it is necessary to supplement it with artificial drains.

FIG. 4—DRAIN PENETRATING WATER-BEARING SAND

Drainage Plan—In the selection of a drainage plan for the Carson Division of the district the following conditions were considered as the controlling factors: (a) The greatest possible area should be drained through Stillwater Slough into Carson Sink, in order to guard against the rise of water in Carson Lake; (b) the drains should be kept within present cultivated limits where possible; (c) the system adopted should consist mainly of a system of main trunk drains, to be extended and expanded as future needs develop.

About 12,000 acres of marginal lands around Carson Lake are now under water-right contract and depend on the present lake, which has an evaporation surface of about 4,000 acres, for the disposal of their drainage water. There are also about 12,000 acres of additional marginal lands which may prove of agricultural value. Any material increase in the size of the lake would interfere with the drainage and successful cropping of the marginal lands; further, as the drainage water carries a considerable percentage of alkali salts, a high concentration of salts in marginal lands might

result, particularly where these have only a slightly higher elevation.

Earlier Drainage—At the time the project was constructed a system of shallow open drains had been built. These drains proved to be insufficient. Irrigation started in 1906, and waterlogging of the lands began soon after and continued to increase as time went on. By the end of 1918, more than 35,000 acres of land had the water table less than 6 ft. below the surface.

Various attempts were made to get the land owners together on a general deep drainage program. Before April, 1919, a total of $75,000 had been spent for deep drains; about $31,000 of this had been spent on tile drainage, which did not prove satisfactory on account of adverse soil conditions.

In November, 1918, the water users on the project organized an irrigation district under the state laws, and on Jan. 22, 1921, entered into a contract with the United States to construct a main drainage system involving an expenditure of $700,000. The system as built is shown by the map, Fig. 1.

Execution of Drainage Plan—Active work started on this contract in August, 1921, all work being done by government forces, and on Dec. 31, 1923, a total of 150.33 miles of open drain was completed at an average cost of $4,656 per mile which includes all charges. A typical drain of the larger size is shown in Fig. 2, while Fig. 3 records the progress in mileage of drain construction. A total of 5,472,751 cu.yd. of material was excavated at an average field cost of 8c. per cubic yard. A total of 1,609,512 ft. b.m. of lumber was placed in 1,034 structures. As the Board of Engineers report accompanying the contract estimated that 100 miles of drain could be built for the $700,000, a very material saving was made, which was highly gratifying to the water users on the project.

Practically all the drains were designed with a bottom width of 9 ft., side slopes 1½ to 1 and an average depth of 8.5 to 9.0 ft. The main diagonal drain had a bottom width of 20 ft. and a slope of 1 ft. to the mile. Most of the drains had a slope of 4 to 5 ft. to the mile.

The excavation of the drains, done by dragline, was handled very rapidly and at gratifyingly low cost. Some notes on this work will be given in a later article.

In many cases, on account of the waterlogged condition of the soil, it was impracticable to excavate the drain to grade the first time. After the water in the soil had an opportunity to drain out (see Fig. 4) the machine would go back over the drain and recut to the grade desired. It was necessary to use pontoon mats under the machines on considerably more than half of the work. These mats were made of round fir piling slung on cables, and handled by the machine.

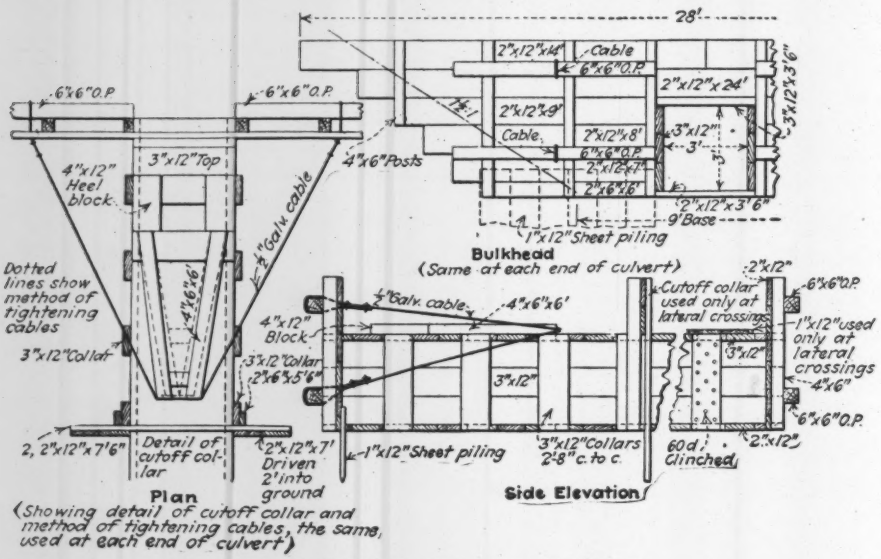


FIG. 5—TYPICAL REDWOOD CULVERT

Nearly all structures were made of redwood lumber, which lasts uncommonly well in this country, particularly in drainage structures, where it is kept wet. The lumber cost about $50 per M ft. b.m., delivered on the project. Structures were cut at the central plant (located on the railroad) and were hauled to the site of installation and assembled there. Most road, canal and lateral crossings were culverts 3x3 ft. in clear cross-section (Fig. 5). They were generally assembled on the surface of the ground. As soon as the dragline machine had completed the excavation of the drain the culvert was lifted into place (Fig. 7), the bulkheads put on and the backfilling done by the machine. A large saving of time and money was secured by this method. This was particularly appreciated by the farmers and the general public, as main highways, canals and laterals were seldom blocked over a few hours. The general rule for determining the length of a canal and lateral culvert

TABLE I—USE OF WATER ON NEWLANDS RECLAMATION PROJECT, 1912-1923

	Truckee Division					North Carson Division					South Carson Division				
		Acre-Feet Per Acre					Acre-Feet Per Acre					Acre-Feet Per Acre			
Year	Area Acres	Del'd to Farms	Loss in Canals	Loss in Laterals	Total	Area Acres	Del'd to Farms	Loss in Canals	Loss in Laterals	Total	Area Acres	Del'd to Farms	Loss in Canals	Loss in Laterals	Total
1912	1,650	5.58	....	....	....	2,087	2.99	....	....	.....	21,315	2.22	....	....	....
1913	2,257	5.85	....	....	....	2,276	3.28	....	....	.....	26,324	1.86	....	....	....
1914	3,050	7.55	....	....	....	2,276	4.61	....	....	.....	23,326	2.62	....	....	....
1915	3,442	6.71	....	....	....	2,275	3.21	....	....	.....	34,578	2.49	....	....	....
1916	3,739	6.87	....	....	....	2,231	3.35	....	....	.....	33,479	2.92	....	....	....
1917	4,042	6.69	....	....	7.89	2,254	3.14	....	....	11.70	34,096	2.68	....	....	....
1918	4,493	6.44	1.60	1.70	9.74	2,364	4.03	3.37	5.17	12.57	35,354	2.49	0.85	0.84	4.17
1919	4,777	5.61	1.38	1.52	8.51	2,628	3.89	4.58	5.67	14.14	36,919	2.63	1.46	1.13	5.22
1920	4,944	4.95	1.75	1.30	8.00	3,400	3.79	2.95	5.34	12.08	37,267	2.48	1.24	1.06	4.79
1921	5,601	5.39	1.38	1.84	8.60	3,671	3.60	2.34	6.58	12.50	36,871	2.42	1.39	0.90	4.71
1922	5,663	6.25	1.14	2.36	9.76	3,400	4.46	3.94	7.10	15.50	35,900	2.54	1.44	0.82	4.80
1923	5,767	6.10	2.20	2.10	10.40	3,296	4.66	5.67	6.24	16.57	35,824	2.66	1.37	1.12	5.15

crossing was to multiply the height of the water surface in the canal above the bottom of the drain by 6 and add to this result the width of the high-water surface in the canal. This gives a 3:1 slope for the hydraulic gradient through the culvert backfill.

Waste-water inlets (Fig. 6) were installed at logical places for waste water to enter the drains. The rough excavation for these structures was done by the ma-

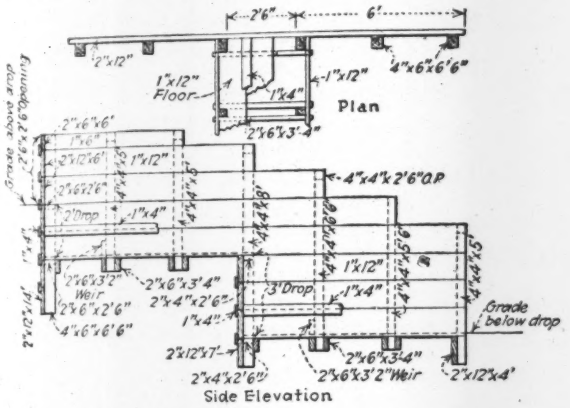


FIG. 6—WASTEWATER INLET TO DRAIN

chines. It is very important from a maintenance standpoint to prevent earth from washing into the drain. In all, 606 waste-water inlets were installed under the contract. A completed inlet is shown by Fig. 8.

Cost of Drains—The cost of items for the 150.33 miles of drain constructed is as follows:

Operation	Cost per Mile	Operation	Cost per Mile
Original investigations	$128	Superintendence and accounting	91
Excavation	2,819	General expense	332
Structures	1,018	Cost adjustments	118
Rebuilding laterals	16		
Engineering and surveys	$134	Total	$4,656

Effect of Drainage—The results obtained from the construction of the drains were gratifying. A general lowering of the ground water is evident in the lands affected by the drains. The outstanding benefit, aside from the general lowering of the ground water, is the furnishing of an adequate outlet for surface and soil drainage waters. A conservative estimate indicates that each mile of drain has protected and benefited an average of 320 acres. Many areas a mile or more from the drains have shown a material improvement in soil drainage and lowering of the ground water. The best proof of the efficiency of the drains is that the farmers are cultivating their fields again and a feeling of confidence and ability to cope with the drainage problem is evident among the settlers.

Table II, giving analyses of soil samples taken on a farm just before and one year after construction of a drain near by, shows conclusively the effect of drainage. Before construction of the drain the soil was practically sterile. During 1923 a fine crop of volunteer alfalfa and sweet clover materialized.

Discharge of Drains—Records were kept of the discharge of drains. The flow on the different drains varied widely, and this is particularly true of the strictly seepage flows. The minimum flow varies from almost zero per mile in the heavy clay soils to 0.60 cu.ft. per second per mile in the sandy soils. The minimum flow occurs in March just previous to starting of the first run of irrigation water. The maximum flows occur in the heavy clay soils in July and in the sandy soils in August. The maximum discharge per mile of drain in heavy soils was 1.98 and in the sandy soils 5.44 cu.ft. per sec. These last figures indicate considerable surface waste.

The total net drainage runoff from water diverted into canal systems was 72.770 acre-ft. for 1923, which is 27 per cent of the total diverted for irrigation. The actually irrigated area which contributed this flow was 45,000 acres. This gives an average yearly runoff of 1.37 cu.ft. per second for each square mile. The runoff per acre amounted to 1.62 acre-ft. per year. The average drainage flow from the farms per mile of drain amounted to 0.68 cu.ft. per second.

Quality of Drainage Water—In connection with the measurements of the discharge of drains samples of the water were taken and analyzed by F. B. Headley, super-

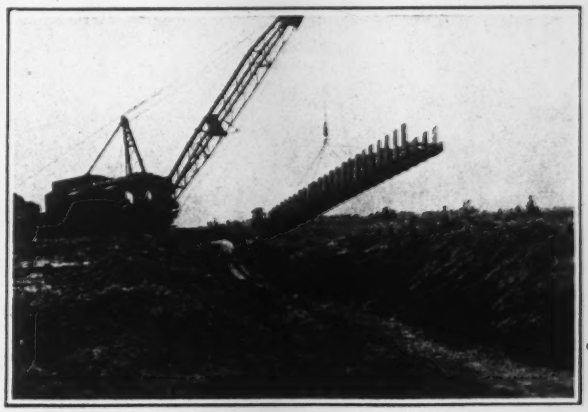


FIG. 7—DRAGLINE SETTING 72-FT. CULVERT

intendent of the government experiment farm. A comparison of the composition of the drainage water with the composition of the irrigation water shows that when the drains are discharging freely, as during June and July, the drainage water carries about ten times as much salt as the irrigation water. Analyses covering the entire year show that the proportion of calcium in the drainage

TABLE II—REDUCTION OF SOIL ALKALINITY BY DRAINS

Sample	Depth Feet	Ca Salts 1922	Ca Salts 1923	$NaHCO_3$ 1922	$NaHCO_3$ 1923	NaCl 1922	NaCl 1923	Na_2SO_4 1922	Na_2SO_4 1923	Totals 1922	Totals 1923
1. Alkali weed bare spot	1	...	.....	1,260	1,008	409	58	905	620	2,619	1,686
2. Alkali weed bare spot	2	...	.....	1,260	1,008	643	58	2,306	450	4,203	1,516
3. Alkali weed bare spot	1	...	.....	1,344	1,175	585	117	2,100	960	4,029	2,252
4. Alkali weed bare spot	2	...	.....	1,933	925	643	351	3,200	1,240	5,776	2,516
5. Entirely bare	1	181	1,081	655	.....	1,111	468	5,400	2,310	7,347	3,859
6. Entirely bare	2	161	1,081	842	.....	1,111	819	2,300	1,280	4,414	3,180

NOTE—Samples taken before and after construction of Lower Soda Lake Drain.

water is much lower than in the irrigation water. In fact the actual lime content of the drainage water is generally lower than that of the irrigation water. This indicates that there has been a marked absorption of lime from the irrigation water accompanied by a displacement of soda from the soil.

During the year 1923 an estimated total of 119,048 tons of alkali were discharged by the drains, distributed in tons as follows:

Month	Tons	Month	Tons
January	3,721	July	16,147
February	4,085	August	15,827
March	3,507	September	14,506
April	7,838	October	10,785
May	11,235	November	9,531
June	14,962	December	6,903

Assessments of Benefits—The constructed work as described is quite well distributed over and benefits the entire district. A practically horizontal assessment of benefits amounting to about $10 per acre has been

FIG. 8—A WASTEWATER INLET OF THE NEWLANDS DRAINS

spread over the irrigable area of the project to cover the expenditure of $700,000.

Organization—The excellent record of economy and efficiency accomplished on this job was made possible by the loyal and co-operative work of the employees of the U. S. Bureau of Reclamation. Very few changes were made in the drainage organization during the 2½ years the work was in progress. The work was done with government forces organized under the U. S. Bureau of Reclamation, of which Dr. Elwood Mead is commissioner and F. E. Weymouth is chief engineer. The writer was engineer in direct charge of the drainage work, reporting to John F. Richardson, manager of the Newlands project. Reporting to the engineer in charge of the work were M. L. Tuggle, general foreman, who was in charge of the installation of all structures at places designated; A. B. Gale, master mechanic, in charge of machine and blacksmith shops, whose particular job was to keep the machines running; and John C. Coniff, chief of field party, in charge of all survey work in connection with the drainage program.

District of Columbia Recovers $302,631 from Garbage and Refuse

THE GROSS operating receipts of the City Refuse Division of the Engineer Department of the District of Columbia for the year ended June 30, 1924, were $302,631, against an expenditure for all purposes of $821,155. The garbage reduction plant handled 75,089 tons of raw garbage from which there were produced 3,607,600 lb. of grease which were sold for $196,619. Including the freight on the garbage from Washington to the reduction plant, 30 miles, the amounts charged to grease production totaled $167,954, leaving a surplus of $28,666. Charges against the "trash plant" amounted to $95,049 and the receipts from paper and other material salvaged totaled $101,743, giving a surplus of $6,693. Low prices for grease, paper, etc., during the year 1923-24 account for a smaller return from grease and salvaged material, although more grease and more of the other commercial materials were produced for sale than in 1922-23. Ash collection costs and other figures are given in the accompanying table.

The total expenditures of $821,155, we are informed

TOTAL EXPENDITURES OF WASHINGTON CITY REFUSE DIVISION, 1923-24

Cost of garbage reduction	$167,954	Cost of collecting dead animals	$6,887
Cost of trash reduction	95,049	Night soil contract	24,000
Cost of garbage collection	281,237	Unallocated expenditures	15,787
Cost of trash collection	98,652		
Cost of ash collection and disposal	131,589	Total	$821,155

by Morris Hacker, supervisor of city refuse, include all salaries, rent, repairs, renewals, replacements, new equipment, etc., during the year but no interest or sinking fund charges, nor any charge for office space in the district building, nor the service of the purchasing, auditing and disbursing offices.

The district paid $85,200 for the reduction plant and other privately owned equipment when it took over the disposal of garbage in 1918. Since then the plant has been remodeled and improved out of the yearly appropriations, so that, according to Mr. Hacker, "it is to-day worth considerable more than the district paid for it." Continuing, Mr. Hacker says: "For example, during the past year one building was practically rebuilt, six new large digestors were installed and a boiler replaced."

The trash-salvaging plant is still privately owned. Rental amounting to $11,500 is included in the 1923-24 expenditures given in the table, while in addition $9,000 is included for land adjoining the plant bought by the district in December, 1923.

New Railway to Be Built in Spain

The government of Spain has approved the project for the construction of a strategic railway from Ontoneda to Calatayud by way of Burgos and Soria, a total distance of 285 miles, according to consular advice to the Department of Commerce. Bids on an estimated cost basis of 348,550,000 pesetas, about $45,300,000, are to be accepted. The government guarantees the interest of 5 per cent on this amount but not on any excess. The work is to be undertaken by an international group formed by Senor Pedraza. It is but a forerunner of a project to construct 2,500 kilometers of Spanish railways.

Estimating the Structural Steel of Buildings

Hints from Experience with the Problems and Difficulties of Estimating—Approximate and Close Estimates—Influence of Specifications—Common Errors and Recommended Cautions

By Robins Fleming
Structural Engineer, American Bridge Co., New York

Taking off quantities from a steel drawing is one of the most routinized of engineering procedures. And yet it is one that requires the greatest care and one in which mistakes may mean a considerable loss of money. Mr. Fleming has here reduced to simple terms the things to be watched and the things to be avoided in steel estimating. It is a practical compendium of great value.

IN A GROUP of four or five men gathered in an office to estimate the steelwork of a group of buildings, one man remarked, "The man who leaves the most out will get this contract." Whether in this particular case the man was right or not is not known, but material left out of an estimate has often determined the award of a contract. An estimator of the steelwork of a six-story building took off the "Typical Floor" as one floor. Another, in carrying out the weights of some heavy girders for an armory, used the areas of cover plates for their weights. A third scaled the lengths of roof-truss members with a quarter-inch scale when they had been drawn to an eighth-inch scale. A fourth counted the rows of purlins from eave to ridge and forgot to multiply by two. In every case the mistake was not discovered until too late to be rectified—the contract had been taken.

This article will deal with estimating and touch but lightly upon questions of design. It is written mainly for those of little experience.

Estimates may be broadly classified into approximate estimates and close estimates. A complete estimate is made up of two parts, the quantity estimate and the cost estimate. The quantity estimate will receive the more attention.

Approximate Estimates—Approximate estimates are often wanted before plans or designs have been made. An approximate estimate of steelwork, classified, sufficient when work is sold on a pound-price basis, but is risky to use for a lump-sum bid. The weight per square foot of floor area or per cubic foot of volume of some existing structure is often assumed to determine the weight of a proposed structure. Before this is done the estimator should be assured that the conditions that will govern the one are the same as they were in the other.

Industrial buildings vary widely as to roof loads, shafting, crane runways, spacing of columns, heights to trusses, all of which enter into the weight of steel. Any formula for determining the weight per square foot of area is practically useless because of the many factors that must enter into it. Proceeding in order, the weight of roof trusses would naturally come first. Empirical formulas are all more or less doubtful in value, but probably the most trustworthy is the one found in the appendix to Schneider's "General Specifications for Structural Work of Buildings." It is,

$$W = \frac{PL}{300 + 6L + \frac{PD}{3}}$$

where W = weight of truss, pounds per square foot of building,

L = span of truss, feet,

D = spacing of trusses, feet,

P = load on truss, pounds per square foot.

If shafting is carried on the bottom chord add 10 per cent to weight for spans 60 ft. and under and 5 per cent for spans more than 60 ft. Or: the weight of ordinary roof trusses may be assumed as equal to the weight of the chords plus 60 per cent. The size of purlins can easily be determined from the load they carry, the number of rows counted and their weight thus found. The weight of side and end girts can by a mental calculation be reduced to a weight per square foot of surface. From 10 to 20 per cent should be added for door and window framing. The weights per lineal foot (minimum 25 lb.) of columns may be assumed at 0.4 times their loads in thousands of pounds with an addition of 3 per cent for every foot of length more than 20 ft. Crane girders and rails should be estimated per lineal foot; probably every estimator is at least once guilty of assuming the weight of rails per yard as the weight per foot. Bracing may be assumed at 10 per cent of the total weight of other items. The steel weight of coal bunkers of the Berquist type with their supports may be taken at 10 per cent of their capacity. An estimator with but little experience should add about 20 per cent to the sum of his weights for contingencies; the skilled estimator will add 5 or 10 per cent.

Office buildings vary as to floor loads, column spacing, the ratio of length of spandrel beams to floor area and in other ways. Ordinarily the steel in a floor can be estimated on a square foot basis by designing and determining the weight of a single panel. The roof can be assumed a floor. The spandrels should be estimated per lineal foot as determined from typical wall sections. For columns, the entire loading, live and dead including the walls, can be assumed to be carried by a single column and the loads obtained for each story height. Sectional areas of the column can be found by dividing the load of the upper section by 8,000, the section beneath by 10,000 and the loads of the remaining lower sections by 12,000, remembering that columns are usually built in two-story lengths and the greater story load must be used in obtaining the area of a section. The weight of the theoretical areas should be increased by 20 per cent for details, which includes grillage, and 5 per cent for the probable excess of the actual sections over the theoretical sections. (This is equivalent to multiplying the loads in thousands of pounds by 0.53, 0.43 and 0.35, respectively, the results being the weights per lineal foot.) Wind bracing and miscellaneous items may be taken at 10 per cent of the

sum of the other items. It is well to add 5 or 10 per cent for contingencies.

An approximate weight of a plate girder may be obtained (after determining the web plate and flange area at center) by multiplying the area of the center cross-section by four times the length of the girder in feet.

Close Estimates—The word "close" is used in preference to the words "accurate," "correct" or "exact." It is nearer the truth. Before beginning such an estimate the estimator should carefully read the specifications. He will find that in many cases they are far from ideal. Of a thousand specifications examined in detail (see "One Thousand Steel Specifications Reviewed," R. Fleming, *Engineering Record*, June 24, 1916) many were so general in their provisions that they lacked definiteness. Some contained "blanket" clauses which might mean little or much. Many were copied from other specifications and the writers had not always used good judgment in copying. Some lacked clearness and others were unfair. A specification is unfair when it places the risk belonging to one party upon some other party. A provision that the steel contractor must check and be responsible for the steel design is both unprofessional and unfair. It is an admission on the part of the designer that he lacks confidence in his work. Long, short, clear, indefinite, severe, unfair, whatever the specifications may be, the estimator must proceed with his work. He usually must place an interpretation upon all ambiguous sentences and supply information where it is lacking.

An estimate to be close should be made in detail. "Detailed estimating" is another name for close estimating. The principle causes of erratic estimating, according to Davies ("Engineering Office Systems and Methods," p. 250) are: (1) lack of systematic compilation, resulting in gross errors of omission and commission; (2) not allowing a sufficient percentage for weights of details; and (3) forgetting to take off the large number of minor items which often form a considerable percentage of the whole weight.

To overcome the first cause, "Reminder" lists similar to those in Davies' or in Ketchum's "Structural Engineers' Handbook" are helpful. The estimator should also make such a list of his own. The number of items that will be added from time to time as his experience broadens will be a surprise to him.

A definite order should be followed in itemizing the estimate. Naturally, the riveted work (trusses, columns, plate girders) would come first. Next would come the partly riveted work (crane beams with channels for lateral stiffness, girts with window and door framing, spandrel beams, lintels of angles or channels bolted or riveted together in pairs and angle bracing). Special work such as brackets of any kind, stair work if required, ladders, castings, any work to be done in the forge shop, might come next. Lastly would come beams, purlins, crane rails and similar work requiring little or no shop work. If the estimate is made from blueprints, material should be check-marked on the prints as it is taken off.

Details should be estimated with the members to which they belong. Details for roof trusses weigh from 15 to 25 per cent of the main members, in special cases 30 or 35 per cent. Plate-girder details are sometimes estimated by percentages, but as they usually consist of stiffeners, fillers and shelf-angles it is an easy matter to estimate them as they actually are, adding 2 to 4 per cent for weight of rivet heads. In estimating the weight of plates the over-run should be included. If size and number of stiffeners are not given they should be assumed and noted on the estimate sheet. The details of columns can be estimated more closely by assuming bases, caps, splices and connections, than by a percentage of main sections. From 1 to 3 lb. per lineal foot should be added for rivet heads of columns without cover plates, 4 to 7 lb. where cover plates are used. Amateurs almost invariably assume too little for details. In fact, no engineer unless he has had considerable experience in detailing is well qualified to estimate structural steel beyond the simplest cases. The weights of standard connections for beams can be taken from a steel manufacturer's handbook.

Care should be taken that minor items are not forgotten. Rivets and bolts for connecting steel to steel should be included, but not those for connecting the work of the other trades. If the building is to be erected by the steel contractor, anchor bolts, loose base plates, loose lintels and material not connected with the main frame of the building should be delivered at the site but put in place by other contractors, and this should be so noted on the quantity estimate sheet. Cast-iron column bases are usually included with the structural steel. About 10 per cent should be added to the weight calculated from drawings for fillets and over-run.

It is usually conceded that when plans and specifications differ the plans govern, but a clause in the specifications may add material not shown on the plans. "According to plans and specifications" often means that when they do not agree whichever gives the greater weight is to be followed. Drawings sometimes fail to show steel that will be needed to complete the structure. It is better to include such material in the estimate, leaving to the contractor to state whether or not it will be furnished. A blanket clause in the specifications may be intended to cover all such omissions.

A question that often arises in estimating is the matter of substitution of sizes. For instance, a design may show Bethlehem girder beams and columns. A number of fabricating firms if they bid on the work will insist on using built-up sections instead of Bethlehem sections. It should be satisfactory to all concerned that proposed substitutions be sufficient in strength for the assumed loads and stresses. Some engineers and architects, however, insist that all substitutions be of strength equal to the members that they replace.

Miscellaneous Material—It is often necessary to include in the quantity estimate of industrial buildings material not strictly structural steel. Sheet metal should be estimated by giving net surface to be covered and also the gross area and weight required. The gross area required for roofs is usually about 25 per cent more than the net, and that for siding about 20 per cent more. In the case of the roof for an octagonal merry-go-round the sheets were cut in the field and the gross area shipped was 40 per cent more than the net area covered. Flashing, ridge roll, louvers, gutters and conductors should not be forgotten. Skylights, tubular ventilators, steel sash with glazing, opening device

for ventilating-sash, doors, should be studied and it should be clearly stated just what is estimated.

Fabricating firms and contractors usually have blank forms to be filled out regarding material, workmanship, paint, field connections, erection, inspection and kindred matters. On the quantity estimate sheet, however, attention should be called to clauses in the specifications to which exception is taken, to unusual requirements in material and workmanship, and to points in either specifications or on drawings that are not clear. Especially should it be stated what is included and, if necessary, what is not included. The latter is often important. If measurements of any kind are to be taken in the field it should be so noted.

There is no such thing as an "exact" estimate. Weights carried out to the nearest 10 lb., or when over 10,000 lb. to the nearest 100 lb., are close enough for all practical purposes. The rolling mills bill material at the weights given in the handbook but exercise the right to a variation of 2½ per cent either above or below the tabulated sectional area. Contracts on a pound-price basis often have a provision that payment shall be made by scaled weight but no excess greater than 2½ per cent of the total weight of the structure as calculated from working drawings will be paid for (some specifications allow 1½ per cent, others 2 per cent). When calculated weights from working drawings are used as the basis of billing, ½ of 1 per cent should be added for each coat of shop paint, or ¼ of 1 per cent for oil if material is oiled (the *average* weights of paint and oil are used).

After a contract is taken, the quantity estimate before being sent to the drafting room should be examined and revised, if necessary, to accord with what is included in the contract. The detailer then knows just what has been sold. If he finds a variance between the estimate and the plans and specifications he can report the same at once.

Cost Estimates—"Get the exact weight and multiply by the exact price" is the exact rule, of course, but the best the structural steel estimator can hope for is accuracy rather than exactness. Cost estimating, while not an exact science, need not be a gamble. It is not a commercial proposition. Experience, close observation, a careful study of records of work done will enable a man, especially one of technical training, to estimate intelligently the cost of fabrication and erection of structural steel from specifications and a carefully prepared quantity-estimate sheet.

The items that enter into the cost of the steel in a finished structure are: base price of material, freight to shop, cost of working drawings, shop fabrication including paint, freight to site, and erection cost. The price is fixed by the rolling mills. Certain shapes and sizes carry an addition to the regular base price. To the base price should be added 3 or 4 per cent for the scrap that comes from fabrication.

In estimating freight both to and from the fabricating plant it should be noted that freight rates are higher for cars partially loaded than for full carload lots. A car loaded with fabricated material such as roof trusses may weigh less than what the railway company designates a carload, but full carload freight will be collected.

The cost of working drawings is a variable quantity —usually estimated too low. Pre-war salaries of draftsmen have nearly doubled. Incomplete information or conflicting data necessitating correspondence and delay, little duplication, changes made during the progress of the work, add greatly to the cost of drawings. Then there are rentals, blueprinting, expenses necessary to the maintenance of an office, all helping to make an overhead to be added to the payroll. On some complicated structures recently finished the cost of drawings including the overhead ran to nearly $20 per ton. The estimator thinks in pounds and tons, but the cost of drawings can be obtained more closely by estimating the number required and multiplying by the probable cost per drawing.

Fabrication cost varies with the nature of the work. Beam work with simple connections may vary from 0.3 to 0.6c. per pound, while the average cost of the riveted work in a structure may vary from 0.9 to 1.7c. per pound. Blacksmith work and machine work are expensive, and if much of either is in a structure the average pound price of fabrication will be sensibly increased. These costs apply only to the ordinary range of steel structures. Industrial buildings, such as cement mills and coal breakers, and office buildings with unusual features, are in a class by themselves.

The cost of erection of a steel structure is the item most difficult to estimate. Not only is there the actual cost of labor and the overhead due to maintenance of equipment, but there is a further overhead due to a multitude of contingencies. Strikes, delay in the receipt of material, bad weather, accidents, are things which every contractor is liable to meet at some time or other and for which he must make provision in his estimate if he expects to remain in business for a term of years. Because of under-estimating erection, many firms of limited capital have gone bankrupt.

To the total of the foregoing items should be added a small percentage to cover the expense of estimating —not only where the estimate ends in a contract but in the greater number of cases where it does not.

Miscellaneous Points—Be careful of the decimal point. More numerical errors occur from a misplaced decimal than from any other cause. After an estimate, either quantity or cost, has been checked it should be scanned (without the use of the slide rule) for misplaced decimal points.

Be careful of additions. Quite an elementary caution, but a number of serious errors in final additions come to mind.

With but little work in a fabricating shop it may be better to take a contract at a loss than not to take it at all. While this may influence the estimator to figure close it should not induce him to leave out quantities or to estimate them "closer" than they really are.

The estimator should not deceive himself. His desire to secure a contract for his firm should not lead him to make his estimate other than absolutely honest.

It is better to include in an estimate quantities not called for but that may be wanted, with an alternate for deductions, than to exclude them with an alternate for additions. For instance, if not sure whether or not gutters and conductors are wanted it is better to include them and add a note: "If gutters and conductors are not wanted deduct . . . ," than to omit them and add a note: "If gutters and conductors are wanted add . . . ."

If a contract for steelwork is taken on a pound-price

basis the purchaser will be pleased to have it ship less than the estimated weight; if taken on a lump-sum basis the contractor will hardly call the estimator to account for a lesser weight. However, it is just as much an error when an estimate greatly over-runs the shipped weight as when it under-runs. Moreover, an over-estimate may cause the loss of a contract.

It is not safe to assume knowledge of a subject regarding which little is known. For instance, an escalator may be wanted for a department store. Aside from the cost of the escalator, which is frightful, the floor framing will need to be arranged for that special purpose. This may be expensive.

Too much should not be counted on in making use of material from an existing building for an extension. It is seldom that corrugated sheet metal can be taken off and used again. The purchaser may insist upon certain steel in the old part being used in the new, but this often costs as much as to furnish new material.

It should not be assumed that working drawings on hand can be used for a proposed "similar" structure unless the two structures are identical. Otherwise it may cost as much to make changes as to make new drawings.

Avoid abbreviations, or abbreviate sparingly. A number of instances could be quoted where abbreviations have been misunderstood or not understood at all.

Do not use the term "etc." It is usually a cover for lack of knowledge.

In blank forms to be filled in, write something after every item. For instance, after "Inspection," rather than leave the space blank write, "None estimated." If nothing is known about "distance to be hauled" or "facilities for storage," write "Not known."

The estimator should not be unduly disturbed by what he hears about a competitor's weight or cost. His information may be incorrect or the other man may have made a mistake. He will naturally scrutinize his own estimate and if not too late to do so will make necessary revisions.

Printed data relating to costs should, if possible, be verified before using. "Published cost figures are often unreliable or misleading. In the first place the conditions are not sufficiently defined to assure an understanding of what estimate of cost the figures actually include, and they frequently omit general supervision and general and overhead expenses. In the second place such figures are seldom given unless they are comparatively low. If work has cost an excessive amount the cost figures are not a matter for congratulation and are seldom published." (Mead, "Contract Specifications and Engineering Relations.")

Finally, the estimator should cultivate a sense of proportion. Unless this is developed he can not to any great extent be a successful estimator.

Oil-Electric Locomotive Built For Switching Service

New Type Engine for Use in City Streets—Direct-Connected Engine and Generator—Motors Geared to Four Axles

TO MEET the peculiar operating conditions of the West Side Yards of the New York Central Railroad Co. at New York City, a new type switching locomotive has been built. The West Side Yards are all at street grades and many of the connecting tracks are in the streets where traffic conditions require slow movement and frequent stops and where it is impossible for a steam locomotive to handle long strings of cars if the acceleration of the cars is lost. An electric locomotive can meet these requirements admirably, but, although the electrification of all these tracks has been ordered, complete electrification is out of the question until plans for track elevation, relocation and other changes in the New York Central tracks and yards are approved by the city and Public Service Commissions.

FIG. 1—THE OLD AND NEW IN SWITCHING LOCOMOTIVES
New 300-hp. oil-electric locomotive compared with an old steam-driven switching locomotive.

The alternative then, pending complete electrification, was the development of self-contained electric locomotives. The result is this oil electric locomotive designed and built jointly by the Ingersoll-Rand Co. and the General Electric Co.

The power plant equipment consists of a 300-hp. oil engine directly connected to a 200-kw. generator. The motive power consists of four motors of a nominal rating of 95 hp. each, one of which is geared to each of the four axles. The locomotive has a total weight of 60 tons, all of which is on the driver.

The six-cylinder engine is designed to burn fuel oil

and has a Price system of direct fuel injection. This system avoids the use of high-pressure injection and also effects a reduction in weight over types of oil engines using high-pressure injection. Fuel is injected into the various cylinders through a distributor by means of a single-acting plunger pump. The lubricating system is of the continuous filtration type by means of which the oil is returned from the crank case through an oil filter before passing into the system again.

All parts of the cylinder, cylinder head and combustion chamber are water-cooled by means of a thermostatically controlled water supply. Water from the water jackets passes through a radiator located on the roof, the amount being regulated by a thermostatically controlled bypass valve located in the circulating lines.

Sufficient oil for 48 hours' constant pulling is carried in storage tanks on the locomotive. The rate of consumption is about 0.43 pounds of fuel oil per brake horsepower and there is practically no smoke, which fact makes the engine particularly desirable for work in city streets. As ordinarily used in switching service the locomotive consumes from 20 to 26 cents' worth of fuel oil per hour.

An unusual feature of the locomotive is the use of a direct current generator supplying current to the motors without intervening accelerating resistances. This is accomplished by using a differential series field on the exciter which automatically reduces the generator voltage with the increase in the amount of current drawn by the motors. The speed of the locomotive therefore automatically increases as the load is reduced, corresponding to the rise in impressed voltage. This control completely eliminates the possibility of overloading the generator or motors or stalling the engine.

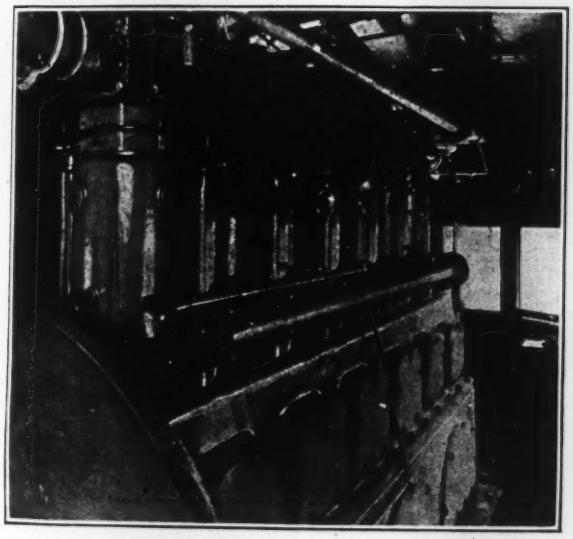


FIG. 2—SIX-CYLINDER 300-HP. OIL ENGINE
Casing of direct-connected generator at lower left-hand corner of picture.

The control is so arranged that the opening of the throttle increases the engine speed and at the same time energizes the exciter field which in turn energizes the generator field. The generator current passes through differentially wound series fields to the driving motors and being opposed to the separately excited field lowers the generator voltage in proportion to the load. As the locomotive accelerates, the current passing through the differential series field is gradually reduced, and the generator voltage automatically increases and speeds up the locomotive. The main excitation of the exciter field is furnished by a storage battery which also supplies control current and light.

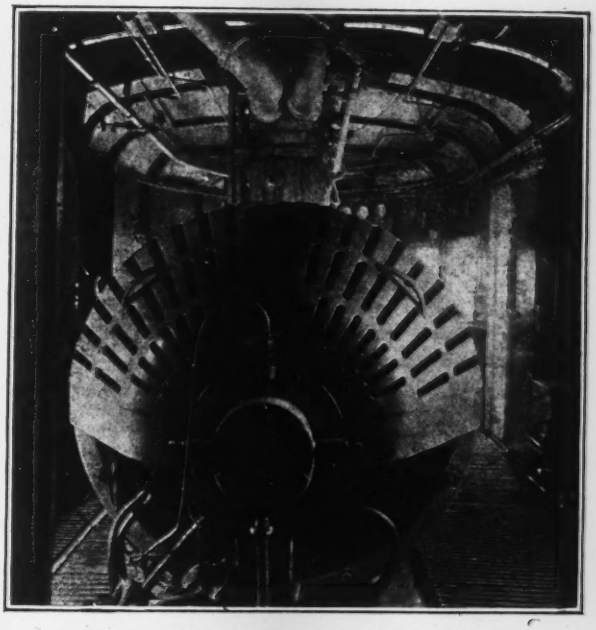


FIG. 3—INTERIOR OF OIL-ELECTRIC LOCOMOTIVE
In the foreground is the 200-kw. generator. The top of one cylinder of the direct-connected oil engine is beyond.

A motor-driven air compressor supplies air for starting the engine and for the air brakes. There is also a gasoline-engine-driven air compressor for supplying air after the engine has been shut down for some time and the pressure in the compressed air tank exhausted.

The locomotive is controlled from either end, the driver having his throttle for controlling the speed of the oil engine, his lever for the control of the motors, the reverse lever, and the air brake control at the right-hand side of the body of the locomotive in both places. There are two set-ups of the motors, one in series and one in parallel, thus providing for speed or heavy pulling. At 20 m.p.h. the locomotive develops 30,000 lb. tractive effort or about 30 per cent adhesion. The engine is geared so that it can make a speed up to 25 m.p.h.

Earthquake Builds High Rock Fill Dam

Speaking before the World Power Conference in London, J. W. Meares of India, related an instance which throws some light on the question of the success of rock-filled dams of great magnitude in valleys. In the Indus valley, there is one place where walls were shot up about 2,000 ft. by an earthquake and rock fell off the top of the walls till it filled the intervening valley to a depth of about 1,000 ft. This dam then backed up three months of monsoon rains until the water finally overflowed the accidental dam. The dam was finally washed away because it was so loosely put together, but in the meantime there was opportunity to study it. There was only a small amount of leakage through the dam and it gave no signs of giving away until it started to wash away at the unprotected top.

Insurance Company Has to Pay Typhoid Death Loss on Accident Clause

THE SUPREME COURT of Illinois has decided that typhoid fevor acquired by drinking polluted water which was supposed to be good is an accident. It therefore confirmed the judgment of the Appellate Court for the Third District by which William H. Christ's mother was awarded $1,130 from the Pacific Mutual Life Insurance Co. (Docket No. 15,631—Agenda 13—Dec. 1923.) Christ was a boiler-maker's handy man and carried a policy providing indemnity for loss of life, limb, sight or time by external, violent and accidental means, and for loss of time by sickness. It also covered monthly indemnity against bodily injuries caused solely by external, violent and accidental means.

The facts in the case, as stated in the decision by the State Supreme Court, were:

> The plea was the general issue, and the evidence was all contained in a stipulation of facts showing that the insured was employed in the railroad shops of the Chicago & Alton Railroad Co. as a boilermaker's helper, on Feb. 3, 1920; that at that time, and for a year previous, there had been two systems of water pipes in the shops—one used for conveying water for drinking purposes for all employees in the shops and the other conveying water for other purposes, such as filling engine tanks, but not for drinking purposes. The two systems of pipes were entirely separate and independent except for one connection at which there was a gate valve, which kept the water in either system from flowing into the other. The water for both systems was supplied by the city of Bloomington from its regular water mains. During January and February, 1920, there was a shortage of water, by reason of which the amount of water supplied by the city to the railroad shops was curtailed and on this account the railroad company during the month of January began pumping water from a small stream, known as Sugar Creek, near the shops, and forcing such water into the system of pipes used to convey water for other than drinking purposes. Sewage from the cities of Bloomington and Normal emptied into Sugar Creek a short distance above the point where the pumping was conducted, and on that account the water pumped was polluted by sewage and other putrid and decaying matter. Shortly before Feb. 3 the valve at the connection of the two systems of water pipes became defective, by reason of which the polluted water in the system used to convey water for other than drinking purposes flowed into the system of pipes conveying water for drinking purposes and polluted the water in those pipes. This condition existed on Feb. 3 and for a week before that date. About a week before Feb. 3, the insured, while going about his usual duties, being uninformed of the polluted condition of the drinking water, several times drank water from the faucet of the system of pipes used to convey water for drinking purposes, believing each time that the water was pure and harmless and fit for drinking purposes, though it was, in fact, polluted. As a result of drinking such polluted water he became ill with typhoid fever, which had its cause in drinking the polluted water, and he continued sick with typhoid fever until Feb. 17, when he died as a result of that disease.

As to whether typhoid is accidental the opinion states:

> A death by typhoid fever cannot be regarded as accidental unless it appears that the disease itself was occasioned by accidental means. The means by which disease is acquired being the entrance of the typhoid bacilli into the system, if the means of such entrance are accidental the resulting typhoid fever and its fatal effect may also be said to be accidental."

Several cases were cited to define the term accident in one of which drinking polluted water is compared to drinking poison thinking it something harmless. In an action (Vennen vs. New Dells Lumber Co. 161 Wis. 370) under the Wisconsin Compensation act an employer had to compensate the heirs of a typhoid victim, the disease being acquired from drinking a polluted supply. Two sets of pipes were maintained and the water became mixed.

Heavy Rainfall at Akron, Ohio, at Time of Lorain Tornado

By Ross C. Durst
Professor of Civil Engineering, University of Akron

AKRON, Ohio, escaped the Lorain tornado on June 28 but was visited by a torrential rain of unusual proportions. During a period of 1 hr. 50 min. a total of 4.3 in. fell at the University campus. The rainfall was continous over the entire time. The intensity was fairly uniform except during the first 13 min. when 1.3 in. fell. This was at the rate of 6 in. per hour. The record was obtained by an electrically controlled, automatic rain gage of the tipping bucket variety. The results were checked by a stick measurement. From a comparison of flood conditions in all parts of the city it is believed that the rainfall in other parts of the city was even greater than at the University.

No record of previous high intensities is available as the gage was only installed in 1921. The entire month of June, however, has averaged but 3.6 in. over a period of 37 years. The average yearly rate over the same period is 36 in. Upon two previous occasions during this same time more rain has fallen but in both cases it was distributed over the entire day. One of these storms occurred during the Dayton flood of 1913.

At the time of the recent downpour the ground was saturated by previous rains. As a result the sewer system was unable to carry away the water and was damaged to the extent of about $50,000. This was due to washouts and clogging by sand.

Although no part of Akron has a flat topography, much damage was done to business establishments. This has been roughly estimated at $400,000. A single firm has filed damage claims for $150,794. Up to Aug. 16 a total of 62 claims had been filed.

J. E. Root, chief sewerage engineer, states that no change will be made in the present method of sewer design as a result of this storm. The rational method is used. The maximum time of precipitation is taken as 32 min. with a corresponding rainfall of 2.5 in. as compared with 110 min. and 4.3 in. for the above storm.

Mr. Root believes it would be neither economical nor practical to design sewers to care for such "acts of God." Since the damage will always be a property damage with little likelihood of loss of life, it will doubtless be more economical to pay occasional damages than to build excessively large sewers.

Station of Est Ry. in Paris to Be Rebuilt

The Paris station of the Est Ry., built in 1855 for an estimated passenger traffic of half a million people a year and enlarged at the beginning of the present century, is to be rebuilt to handle the present traffic of over 20,000,000 passengers a year. The new station will be extended 210 ft. to the east and will require the demolition of an important group of buildings. The façade of the present building will be retained in so far as possible. There will be 28 tracks in the head-house and an elaborate sub-basement in which will be housed many of the auxiliary services.

Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

Thin Lumber and Honesty

Sir—Referring to the editorial on page 207, Aug. 7, on "Standardizing One-Inch Lumber," the attached letter [printed below] from an old lumber-man suggests that this was more a matter of profiteering than refinement in the methods of machinery in the lumber trade.

I am curious to know since when "Advancing civilization has progressively done away with wooden nutmegs, silk and wool made of substitutes * * * ," and the other articles you mention in the last paragraph. Advancing civilization may attempt to do these things, but, judging from the reports of the inspectors of weights and measures of various cities, while some of these are possibly being held down, I question their having been done away with.

W. R. DUNHAM, JR.

Detroit, Mich.,
Aug. 21, 1924.

Department of Street Railways.

Referring to the editorial, "Standardizing One-Inch Lumber," may I give you my idea of how the fictitious one-inch lumber came about? The author states, "probably the explanation goes back to the early ages when lumbering and sawmilling were crude, backwoods arts." From an experience dating back to 1882 I can positively assert that no such skinning was practiced in the "early ages," and judging from the author's probabilities and assumptions, his personal knowledge of lumbering conditions does not date back more than 42 years.

The author further assumes "that, in those days gang-saws were spaced one inch in the clear, to produce one-inch rough boards, provided the saw kerf did not turn out to be too wide. Dressed lumber made from the rough board would naturally be about a quarter inch thinner, and as the principal stock dealt in was the rough stock, and the saws could not readily be changed to make odd thicknesses, the one-inch dressed lumber of ¾-in. thickness became an established article of the trade." He is correct in his assumption that gang-saws were so spaced, the saw-kerf being the thickness of the saw plus set of the teeth, so that the saw-kerf would have no bearing on the thickness of the board. At this stage of manufacture we still had a one-inch board measuring an inch or a little full. Most of this lumber was shipped in the rough to the wholesalers, who, in turn, may have further reduced it to ceiling, flooring, sheathing, or other standard stocks, but, even so, it came to the ultimate user as ¾-in. Most of the planing was done by the retailer, and ¾ in. was the standard thickness to finish. Later on in the "early ages," to save freight, the custom became quite general to plane before shipping from the mills, particularly in the case of the various pines, but ¾ in. was invariably retained as the standard for one-inch planed or dressed lumber, instead of dressed lumber being "naturally about a quarter-inch thinner." Further, it was no more of a job to gage gang-saws 1¼ inch or 1⅛ in. between saws than to gage them for one-inch stock, but, for the sake of argument, we will allow he is correct in his statement that the saws could not readily be changed. With his correct assumption that gang-saws were "spaced one inch in the clear," he still does not show why one-inch dressed lumber today need only be ¾ in. or ⅞ in. in thickness.

It is only in very recent years that thin dressed lumber has appeared in the eastern markets, and, if I may be allowed to assume, it would be that such practice is coincident with the entering into the business of a younger and smarter generation, whose standards of measurements are not those of their fathers and grandfathers of those early ages.

The remedy, to my mind, is not in national or other conference, but in boycotting the fellow who seeks to make 17 or 18 boards grow where only 16 grew before, unless there is such a demand among the trade for ¾-in. lumber that it is fairer to reverse the operation.

In the next to the last paragraph, our author states, "Today it is well within the range of sawmill technique regularly to produce rough stock in thicknesses that will yield dressed lumber of even dimensions." Granted; but it is also true that sawmill technique has not changed since the early ages. He further says, "All the conditions that brought into being the former wrongly-named standard of thickness have been wiped out, but the traditional bad practice remains." Not "wiped out" for those conditions never existed, but a bad practice does exist, I'll admit, of dividing an inch into 13 instead of 16 parts.

Verify the above by interviewing some of the honorable old grayheads in the business, whose gages for gang-saws or for general honesty were standard 12 inches to the foot.

T. H. NEWBOLD.

More on Rail Steel Bar Tests

Sir—Prof. J. B. Kommers, in *Engineering News-Record*, July 24, 1924, p. 146, comments upon tests of rail steel reinforcing bars made at Purdue University in 1913 for a committee of the A.S.T.M., and reported in *Proceedings*, A.S.T.M. vol. 13, 1913. He desires to know the weight of the rails from which the bars were rolled. I have consulted the reports made by Prof. H. H. Scofield, now of Cornell University, and find that the rails varied from 80 to 50 lb. per yard, as indicated in one of the tables of the report. These samples were collected from five mills during the process of rolling. The report of tests represented 2,036 test pieces, yielding 1,719 tension tests and 1,246 cold bend tests of standard form.

No doubt, as Professor Kommers says, the ductility of steel is in large part determined by the carbon content. The comparison of a high carbon steel with a steel of intermediate grade will be known in advance. At the same time a high carbon steel must be bent in a manner appropriate to its qualities if it is to be bent at all. Speed of bend and temperature should be known. The Purdue tests in cold bending were made in a torsion testing machine (see Fig. 2 of the report) with a sliding filler. The object of the arrangement was to secure uniformity of action; one result was to lessen the tension which would otherwise exist in more marked degree in the outside of the curve of the bent bar. The speed was slow and steady. Cold bend tests made around pins without sleeves, and with a surging effort as is often the case in the field will certainly punish high carbon steel.

What we want to know is the legitimate use of high carbon steel for reinforcing bars. One might venture the remark that much of the disputation of the past eleven years has added more heat than light. Once the underlying inquiry has been answered, the origin of the various classes of steel can be evaluated. It is unfortunate that the efforts of the Joint Committee on Concrete to finance a broad investigation of reinforcing steel were unavailing, including the proper design of deformed bars.

At present we have the Purdue tests referred to. Then the report of the Secretary of Commerce for 1922 refers to an investigation made by the Bureau of Standards on samples of rail steel bars collected from the market; in addition to the standard cold bend test the tension test on a bent bar was included. This latter test was first made by the Corrugated Bar Co. to detect possible cracks induced by bending. Now Professor Kommers in Bulletin of the University of Wisconsin, Engineering Series 1252, Vol. IX, No. 3, reports the tests of two lots of rail steel bars, one of which, consisting of 40 bars, was normal, and the other, consisting of 80 bars, was a horrible example. Professor Williams of the University of Illinois, formerly of the University of Kansas, in the preparation for the building of the Kansas stadium investigated the admissibility of rail steel bars (see *Proceedings*, Am. Conc. Inst., Vol. 19, 1923, p. 220.)

The splendid resources of the University of Wisconsin, and the distinguished technical staff there available, would render a great service to enter into this field of research, of which the design of reinforcing of roads has now become a part.

W. K. HATT,
Professor of Civil Engineering,
Lafayette, Ind., July 29, 1924. Purdue University.

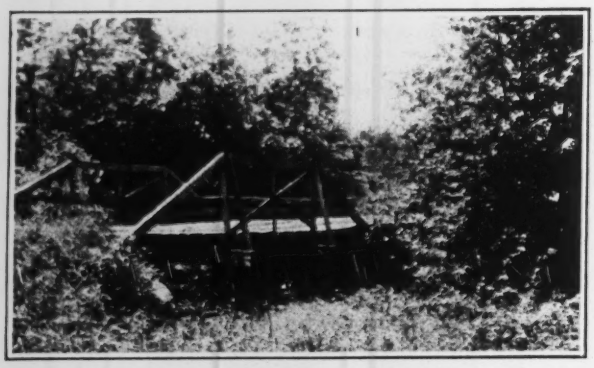
Heavy Rainfall at Chapel Hill

Sir—On Sunday morning, Aug. 3, there occurred in this region, between midnight and 9 a.m., an intense thunderstorm having a measured precipitation at Chapel Hill of 5½ in., and probably exceeding this by several inches over a large area. The maximum rate of rainfall occurred after several hours of steady downpour, resulting in a maximum runoff in the valleys of nearby streams. In Morgan Creek, with a watershed of but 33 square miles, and an average annual runoff of 35 sec.-ft., the water rose 30 ft. in the vicinity of Chapel Hill, completely submerging the state highway concrete bridge on the Durham-Pittsboro road, washing out its embankment approaches and throwing an old iron highway bridge, nearby, to the bottom of the stream. The accompanying view shows conditions after the water had subsided.

STATE HIGHWAY CONCRETE BRIDGE, AFTER FLOOD
The water rose 2 ft. above the parapet of this bridge, on the state highway, near Chapel Hill.

An estimate based on approximate float measurement of velocity and checked by several cross-sections of the stream bed along a profile of three miles indicates a maximum rate of discharge of at least 1,200 sec.-ft. per square mile. In the upper valley of Morgan Creek, above the confluence of two other tributaries of equal size, at the site of the proposed reservoir for the new water supply of the University of North Carolina at Chapel Hill, where the drainage area is 5 square miles, a float measurement and cross-section of the stream showed a runoff in excess of 1,000 sec.-ft. per square mile for several hours. The total estimated runoff for 33 square miles was over 6 in. in ten hours.

A photograph shows the old wooden bridge at this point, which at flood level was nearly 2 ft. under water. The picture was made two months ago, since which time the old trusses (which then carried no load) had been removed. Timber bents and a concrete pier actually support the floorbeams. Although the stream carried a large amount of debris, including logs, no damage was done to this bridge. Many others in the vicinity were washed out.



OLD WOODEN BRIDGE OVER MORGAN CREEK

From residents in the drainage area of Morgan Creek I obtained statements of the rainfall measured at two points in the upper 10 square miles of its basin. In one case a catch of 10 in., and the other 9, in depth was measured in an open container under conditions indicating a reasonably accurate measure of the rainfall in that vicinity. It is probable that this figure was exceeded at other points and that 9 or 10 in. is a fair average of the rainfall over an area of between thirty and fifty square miles, as other streams in the vicinity also had record floods.

Chapel Hill, N. C., Aug. 19, 1924. HENRY WELLES DURHAM.

Filter Men Study Alum Mixing

Sir—The editorial in *Engineering News-Record*, July 31, p. 166, entitled "Filter Men Study Alum Mixing," was read with a great deal of interest. It is felt, however, that a misconception has developed regarding the intended meaning of a statement of mine, "Diffusion is very rapid," in my paper, "Alum Agitation Studies at Reading, Pa.," published in *Engineering News-Record*, July 17, p. 101.

When this paper was written the literature bearing upon the subject of coagulation was gone over carefully and numerous references to the diffusion of dissolved materials into water were reviewed. The general opinion was found to be that the diffusion of ions or the molecules of dissolved materials into quiescent water is slow, as pointed out in the editorial. In dealing with conditions in the mixing experiments discussed in the paper or in large-scale mixing basins, however, quiescent conditions never obtain, even when the rate of agitation is slower than the minimum used in practice. Therefore, the alum solution does not spread into the treated water by diffusion only, but by diffusion aided by physical mixing or distribution. The mixing operation or period was thus separated into two phases: first, that needed for the distribution or diffusion of the added alum; and second, that needed for the rapid formation and growth of the floc.

The determination of the hydrogen-ion concentrations of treated waters at various steps in the mixing process at the Baltimore filters was part of a study reported by Edward S. Hopkins in *Engineering News-Record*, Feb. 1, 1923, p. 204 ("Experiments on Formation of Floc for Sedimentation"). These studies show that at the first turn of the mixing basin, very soon after the alum was added to the water, the hydrogen-ion concentration had reached the point obtaining thereafter throughout the mixing period of about 30 minutes. These results were likewise obtained in the small-scale experiments in Reading, where stable pH values had developed about 15 sec. after the alum was added. The point where stability of the pH value occurred indicated complete diffusion of the alum, otherwise the hydrogen-ion concentration would have shifted as the concentration of alum varied in different portions of the treated water, as the mixture was becoming more uniform.

Having these facts in mind, the following statement was made in the second paragraph of the paper on alum agitation: "They (data) show that mixing serves a dual purpose, that of aiding diffusion of the added chemical, and facilitating the intimate contact between the floc and the suspended matter of the water. *Diffusion is very rapid* in any case, so the chief value of thorough mixing is to aid the physico-chemical mechanism of coagulation by agitation." It is thus seen that the statement refers to the rapidity of diffusion under mixing conditions, and not those discussed in the editorial.

CHARLES R. COX,
Assistant Sanitarian, New York State Department of Health.

Albany, N. Y., Aug. 11, 1924.

[The diffusion experiments in the Philadelphia tanks (mentioned in the editorial note referred to by Mr. Cox) were carried out in round-the-end baffled sedimentation basins where the velocity of flow did not, of course, approximate those of a mixing basin. Some recent experiments in Chicago on the diffusion of chlorine in the pump wells have indicated that the rate is not so rapid as had been supposed and relied upon for several years. With a changing temperature of the water one can readily understand that a cold, heavy water would hug the bottom of a slow-velocity basin to such an extent as to materially reduce the ultimate equal diffusion of the chemical with all of the water.—EDITOR.]

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Tests Under Way on Arch Dam in Oregon

Tests and experiments are being made on the Emigrant Creek arch dam now under construction for the Talent Irrigation District in Oregon. A total of $1,500 for experimental work on this structure has been subscribed by the state of Oregon, the California-Oregon Power Co., the owners of the dam and Engineering Foundation's committee on arch dam investigation. The studies are to include the measurement of stresses, deflections and temperatures of the concrete during construction and afterwards, as well as laboratory tests of the concrete to determine its various properties with increasing age.

The dam is being built across a canyon about 350 ft. wide at the crest of the dam. The maximum height of the structure will be 125 ft. and the thickness of the arch at the base 19 ft.

The experiments will be made under the direction of a subcommittee of the Engineering Foundation committee on arch dam investigation and includes the following: D. C. Henny, consulting hydraulic engineer, Portland, chairman; F. C. Dillard, district engineer Talent Irrigation District; P. O. Crawford, chief engineer, California-Oregon Power Co.; H. M. Chadwick, assistant state engineer of Oregon.

Construction Council Meets October 2 and 3

The annual meeting of the American Construction Council is to be held in New York City, Oct. 2 and 3. In addition to the program for the general sessions, deliberations of the board of governors will include the customary semi-annual review of conditions affecting the construction industry and authorization of a statement for issuance to the public on this subject.

Among those subjects on the program for the general sessions are: "Better Building," which will be a discussion of ways and means to insure better quality of construction and the promotion of greater responsibility among all elements in the industry; "Engineering Construction," which will be a discussion of fundamental relationship between the elements in the industry pertaining to engineering construction, field projects, highway construction, public carriers, etc.; "Apprenticeship," a survey of the apprenticeship movement for the building trades throughout the country; and the "Building Congress Movement," which will be a group meeting of the various local building congresses throughout the country.

The names of speakers for the particular sessions and other details are to be announced later.

Opposes National Subsidy for Land Reclamation

A radical attitude toward land reclamation policies is expressed in a statement given out by Secretary Wallace of the Department of Agriculture in connection with the issuance of a bulletin entitled "Land Reclamation Policies in the United States," written by R. P. Teele. The statement says:

"It is urged that public aid for land reclamation should be conditioned upon the same degree of security for repayment of advances that is required in other fields. The department sees no present justification for a national subsidy to land reclamation, declaring that if local interests justify the subsidizing of land reclamation the subsidy should be local."

It also supports views that have been much discussed, as follows:

"A high degree of public supervision of construction and operation during the development period, or actual public construction and operation is urged if public aid is employed in financing reclamation. * * * It is felt also that there should be sufficient public supervision of private enterprise to prevent misrepresentation or fraud in the sale of both securities and lands.

"The department considers that the chances of financial success of both public and private enterprises will be improved by making preparation of land for immediate use a part of reclamation work and by providing capital for improvements and equipment. This involves a high degree of supervision of agricultural operations until repayment of advances has progressed sufficiently to make the security for the balance ample."

Reclamation Field Forces Highly Commended

A circular letter just issued by Secretary of the Interior Hubert Work and Commissioner of Reclamation Elwood Mead expresses high commendation of the faithful and efficient manner in which the staff of the Bureau of Reclamation has dealt with the difficult problems presented by the past season.

The circular letter states that the year has in many ways presented more difficulties than any since the beginning of reclamation; "to the financial distress of settlers and the critical attitude which this has engendered, there have been added the difficulties and losses which come from drought, hail, and insect pests," and the position of those charged with the administration of the work and the delivery of the water has been correspondingly arduous and difficult. The letter then expresses the appreciation of the Washington officials for the high character of the service rendered by the staff.

Reclamation Bureau to Ask American Falls Dam Bids

Decision Reached After Consideration of Force Account By Special Board of Engineers

After extended consideration of the desirability of force-account construction or contract construction, the Bureau of Reclamation has decided to ask contract bids for the construction of the American Falls dam on the Snake River, at American Falls, west of Pocatello, Idaho. This dam is to provide storage of somewhere between 1,000,000 and 3,000,000 acre-ft. for supplementing the supply of existing irrigation projects along the Snake River below American Falls, and for irrigating additional land. Various irrigation districts have already purchased storage rights in the reservoir.

Money enough is on hand at present for constructing a reservoir of minimum size, but there is a likelihood that additional money will be received within a short time to permit the construction of a larger reservoir. Bids, therefore, will be invited for a dam to impound 1,040,000 acre-ft. as well as for one to impound 1,700,000 acre-ft. The structure will cost several million dollars. It will be of concrete in its main portion, with terminal embankments. The site is on the main line of the Oregon Short Line. Full explorations have been made, and the construction conditions are known with unusual definiteness.

Force Account Studied

The proper construction method for the American Falls dam was recently considered by a board made up of engineers of the Bureau of Reclamation and representatives of various Idaho interests concerned in the proposed reservoir. This board recommended in favor of construction by force account. Earliest possible beginning of construction on the project is desired by all parties, and the Bureau of Reclamation forces which have just completed the Black Canyon dam are available at once, together with ample equipment for the work.

Upon review of this finding in Washington, however, it was decided to invite contract bids on the grounds of general policy. The present attitude of the Washington authorities is that whenever a piece of construction work permits of making definite specifications, contractors will be given an opportunity to bid, while any work that can be better done by force account will continue to be done by that method. In view of the ample construction equipment of the bureau, it is believed possible that in case the bids for the American Falls dam are found unsatisfactory, construction may yet be done by force account.

Delaware River Bridge Cost Increased $8,340,169

Increased Land Values Add $4,479,166 To Estimate—Construction Cost 20 P. C. Higher

Revised estimates for the Delaware River Bridge between Philadelphia and Camden indicate that the total cost of the structure will reach $37,211,169, as compared with original estimate for the work of $28,871,000. The increase of $8,340,169 in the cost is made up of an increase in costs of construction of $3,861,003 and an increase in the costs of real estate required for the bridge of $4,479,166. When the original estimate was prepared in 1921, the costs of real estate were estimated 25 per cent higher than the assessed valuations at that time. Striking increases in real estate values have occurred since that time, particularly in Camden. The 1921 estimate for Camden property was $1,683,000, whereas the cost is now placed at $3,237,817. In Philadelphia the total cost of real estate is now placed at $7,707,420, as compared with the original estimate of $4,709,000. Against these two increases in costs, there is an estimated saving in administration costs of $74,071.

Until the early part of 1924, the bids on construction contracts closely approximated the original estimate, and it was expected that the cost would be within the estimate. Contracts awarded this year for the main steelwork and for granite, however, have shown marked increases, due principally to advances in the prices of labor and materials, and partly to the provision in the work for future increased facilities that might be desired on the bridge. Costs of granite and paving are about 50 per cent above the original estimates, and other items of the work in which labor is an important factor show marked increases. In addition to these added costs for labor and materials, the costs of construction in Camden have been increased by the necessity of extending the foundation for the Camden anchorage deeper than had been anticipated, and of using concrete pile foundations for the Camden approach.

With these increases the cost of the bridge to the two states and the city of Philadelphia will be as follows:

State of New Jersey.....	$15,641,845
State of Pennsylvania.....	10,784,662
City of Philadelphia.....	10,784,662

Water-Borne Typhoid Yields to Anti-Typhoid Vaccine

The water-borne typhoid outbreak at Havana, Cuba, noted in our issue of Aug. 28, p. 355, continues to diminish according to information sent to this journal on Aug. 26 by Dr. D. T. Lainé, who attributes the decline to the use of anti-typhoid vaccine. Dr. Lainé states further: "There is no doubt that the epidemic was caused by the use of the Almendares River water, which has never been filtered and for long periods during the past four years had never had any chlorine added to it."

Dr. Lainé asserts in a recent article in the Havana *Post*, that "the only solution" of the local water-supply problem is "the immediate expenditure of from $2,000,000 to $2,500,000 for settling tanks, filtration and chlorination," while indirectly he advocates metering through stating that Havana consumes 80 m.g.d. of water compared with half that amount used by New Orleans, a city "with the same population." New Orleans uses meters, he says, while only in "exceptional cases" are they used in Havana.

Diversion of Rivers Into Great Lakes Actively Considered

The Montreal Board of Trade is studying a proposal recently made by Ralph Keemle, an engineer of Chatham, Ont., to increase the drainage area of the Great Lakes by diverting the Ogoki and Albany Rivers from the Hudson Bay watershed into the watershed of Lake Superior. The estimated cost of the work is $5,000,000.

In discussing this proposal, F. W. Cowie, consulting engineer of the Montreal Harbor Commission, said:

"Insofar as Mr. Keemle's proposal is concerned, I may say that it is quite a possible feature. Five million dollars, however, is a very low estimate of the probable cost. I am of opinion that such a development would cost at least twice that sum, but it would be well worth while, even at twice that price. The height of land on the north of Lake Superior is a considerable distance from the shore line, and much work would undoubtedly have to be done in the way of digging canals, etc., to handle the adjusted flow. The proposal to include in the work equipment for regulating the flow is most important, for the sudden addition of some 20,000 sec.-ft. to Lake Ontario, for example, might have disastrous results, if unbridled."

Mr. Keemle proposes to take advantage of the relatively flat formation of the height of land between the Lake Superior watershed and the Hudson Bay watershed by placing dams on the Albany and Ogoki Rivers forming reservoirs with outlets into rivers flowing into Lake Superior, thus increasing the watershed by some 20,000 sq.mi. and making the water from this area available for power and navigation purposes rather than have it go to waste into Hudson Bay.

INCREASED CONSTRUCTION COST OF DELAWARE RIVER BRIDGE
(Real Estate and Land Damages not included)

	Original Estimate with Contingencies	Contracts	Contract Cost to Date	Estimated Cost Future Contracts	Difference Between Original and Present Estimated Total Cost	Increase
MAIN SPANS						
Main piers	$2,029,300	1—Borings	$15,975.87			
		2—Main piers	1,641,878.95		$1,671,055	—$358,245
		Pier protection		$13,200		
Main towers	1,582,300	6—Towers	1,440,571.02			
		Railings, light and ornamental metalwork, lighting, painting, elevators, etc.		122,100	1,562,671	—19,629
Anchorages	4,540,500	3—Demolition	8,499.99			
		4—Philadelphia first section	916,841.05			
		5—Camden first section	1,217,811.58			
		7—Anchorage bents	357,247.80		5,601,550	1,061,050
		15—Main contract	2,977,450.00			
		Light and ornamental metalwork, lighting, paving, drainage, etc.		123,700		
Cables	2,650,500	8—Cables	2,546,900.00			
		13—Bands	404,850.00		3,073,850	423,350
		Wrapping, painting, etc.		122,100		
Suspended structure	3,416,400	14—Suspended structure	2,888,000.00			
		Floor slab, paving, track ties and grating, railings, lighting, painting, etc.		834,900	3,722,900	306,500
Philadelphia Approach	3,796,000	9—Demolition	94,363.00			
		11—Piers	231,000.00			
		16—Sewers	173,464.00			
		17—Metalwork	1,511,850.00		5,121,677	1,325,677
		Railings, lighting, floor slab, paving, Contract No. 19 and plaza, etc.		3,111,000		
Camden Approach	2,799,000	10—Demolition	55,388.00			
		12—Piers	310,562.50			
		18—Metalwork	1,793,650.00		3,663,800	864,800
		Railing, lighting, floor slab, paving, Contract No. 20 and plaza, etc.		1,504,200		
Engineering Expense	1,249,000		845,600.00	660,900	1,506,500	257,500
Totals	22,063,000		$19,431,903	$6,492,100	$25,924,003	Net increase $3,861,003

DISTRIBUTION OF INCREASE

	Philadelphia	Pennsylvania	New Jersey	Total
Distribution, additional funds required for work included in original estimate	$1,082,970	$1,082,970	$1,695,063	$3,861,003
Estimated construction cost Fifth St. underpass is $617,000 without land damages	308,500	308,500		
Distribution of additional funds required, including construction cost Fifth St. underpass (Land Damages, Real Estate and Administration expense not included)	$1,391,470	$1,391,470	$1,695,053	$4,478,003

Cincinnati Voters Defeat Improvement Bonds

Issue of $7,000,000 Defeated — Engineers Approved 18 of 45 Projects— Too Much Politics Charged

By a ratio of 2 to 1 the voters of Cincinnati on Aug. 12 defeated a proposed bond issue of $7,000,000 designed to meet the cost of 35 street, six sewer and four grade-crossing projects. The Engineers' Club of Cincinnati, after an investigation, had favored 18 of the street improvements and also the Millcreek intercepting sewer, and these recommendations had been joined in by the Automobile Club and endorsed by the directors of the Cincinnati Chamber of Commerce. The entire program had been endorsed by the Federated Civic Association of Hamilton County and by the Republican county organization. Donald Bronson, resident engineer of the Technical Advisory Corporation of New York City, endorsed the proposed improvements as conforming with the city plan of Cincinnati proposed by the corporation.

Disapproval of the bond issue had been voiced by the Citizens' Survey Committee, this committee being opposed to bond issues for such improvements and advocating the formulation of an improvement program extending over a number of years. Opposition to the bonds was also voiced by the Cincinnati Real Estate Board, the Cincinnati Association and the Horace Mann Welfare Association.

An apparent strong factor in the defeat of the bonds was a recent report on Cincinnati municipal affairs, made by Lent D. Upson, of Detroit, and Prof. Thomas H. Reed, to the City Survey Committee appointed by the Republican Hamilton County Executive and Advisory Committee. The "essence" of this report, according to an editorial in the *Commercial Tribune* of July 30, "is that the present run-down condition of Cincinnati as a municipality is too much politics of a sort and too little planning ahead of another sort;" not "lack of integrity" but "lack of intelligence in management."

It is stated that with one exception all of the earlier bond issues proposed by the present administration have been defeated, and that the one that did carry—$3,330,000 bonds for the Central Parkway—was defeated the first time it came up. A proposed $8,500,000 school bond issue, to be voted on in November, is said to have been taken into account by those who voted against the $6,000,000 bond issue on Aug. 12.

Editorial comment on the bond election appeared in our issue of Aug. 21, p. 289.

Propose 360,000-Hp. Plant

The Susquehanna Power Co. will make application to the Federal Power Commission in the near future for a right to develop 360,000 hp. on the Susquehanna River at Conawingo, Pa. The preparation of plans to be submitted with the application for a license is now in progress. The power is to go to the Philadelphia Electric Co.

St. Lawrence Problem Am. Soc. C.E. Fall Meeting Topic

The principal paper at the technical session of the fall meeting of the American Society of Civil Engineers, to be held in Detroit, Mich., Oct. 22-25, will be that one read by F. C. Shenehon on the St. Lawrence deep waterway problem. That paper, which will be followed by a lengthy discussion, will be read Thursday, Oct. 23, following the addresses of welcome and the response. The entire day will be devoted to discussion of this problem.

A number of other meetings of technical interest will be held, among them a joint session of the Sanitary Engineering Division with the laboratory section of the American Public Health Association, on Oct. 22, and the meetings Friday, Oct. 24, of the various technical divisions of the society. At these latter sessions the following program has been arranged: Power Division, "The Work of the Committee on Ice Trouble at Hydro-Electric Plants"; Sanitary Engineering Division, "Recent Developments in English Sewage Treatment," "Treatment of Sewage at Chicago," and "Sewage Disposal and Water-Supply Problems in the Detroit Area"; City Planning Division, "Factors in the Zoning of Cities," and Highway Division, "Highway Transportation in Pennsylvania" and "Traffic Regulation on State Highways."

A number of social and other features have been prepared. The first day, or Oct. 23, will close with an informal dinner and social evening at the Tuller Hotel, convention headquarters. Friday afternoon optional excursions are planned to the Ford motor works, Detroit Edison plant, Detroit water-works and sewers. After the excursions, members and guests will be entertained at a dinner at the Detroit Yacht Club.

The fall meeting will be concluded on Saturday with two optional features —a meeting of the City Planning Division and an all-day excursion to Ann Arbor, Mich. On Saturday morning the City Planning Division will hold a meeting devoted to a discussion of various phases of the influence of zoning on the design of public utilities, following which there will be an automobile ride about the city for those interested in city planning.

Baltimore Building Inspector Would Double Staff

Charles H. Osborn, building inspector of Baltimore, has asked that the number of inspectors in his department be increased from 20 to 40 in 1925 because of the great amount of work the department is called upon to perform. The official has made provision for this increase in a 1925 budget which has been submitted to the board of estimates for approval. An increase from $5,000 to $12,000 in the salary of the building inspector also is asked on the ground of added duties, including the chairmanship of the zoning commission.

The budget provides for a total appropriation of $773,750 for 1925, including $170,500 for salaries and $474,250 for expenses.

Random Lines

Technical English

At the British Empire Exposition, according to London *Engineering*, there is exhibited a new "electric putter." Fortunately for the golfer engineer who learned English west of the Atlantic there is a picture of this device, which shows it to be merely a form of mine hoist and not an additional hazard of the links. Putting, the golf professionals tell us, is a highly individualistic performance. Its technique should not be standardized by machinery.

*

The matter of technical English is interesting. This same article contains the following sentence "For hauling tubs up steep brows * * * a portable stetcher bar mounted hoist driven by compressed air is often used." Which is understandable, but funny to the American ear. And yet a Spanish correspondent last week suggested we were plum ignorant because we intimated that it would be desirable to have English in South America taught by Americans and not by Englishmen. An Argentine who studied the kind of technical English that specializes in tubs and putters might find it difficult to do business in the United States.

*

After writing the above we picked up an American newspaper with the following sentence: "Ground excavated from tunnel is loaded on wagons by means of a lift and dumping vat." Honors are now even.

* * *

Some Holdovers

Crating Engineers—Another name for the Box Engineers of the Weyerhauser Co.

Chiropactic Engineer—A first cousin to the Osteopathic Engineer previously noted. This particular one, a Mr. Peters of Kansas City, "is especially interested in research work pertaining to the connection of pyrometry with chiropractic" and he has devised a neuro-pyrometer. Indubitably an engineer.

* * *

How to Advertise

From a newspaper write-up:

The Blank Bridge Company maintaining one of the largest fabricating plants in this section of the country, manufacture structural steel for all purposes connected with building.

All the materials that the firm uses are the best that are available and the workmanship is also of the best procurable. Steelwork in structures must be the best possible in order to insure the safety of the building. A weak girder causes many buildings to fall. Therefore it is advisable for the man about to build to select the best that is at hand.

Tresses, columns and riveted work of all kinds are supplied by the company, and the reputation of the company has spread so that out-of-town orders are coming in ever-increasing numbers.

Civil Service Examinations

UNITED STATES

For the following civil service examinations, apply to the U. S. Civil Service Commission, Washington, D. C., or to any local office of the Commission.

Junior Engineer — Vacancies in the Bureau of Standards, Bureau of Mines, Bureau of Chemistry, and other branches of government service, at entrance salary of $1,860, with possibility of advancement to $2,400; examinations are to be in the following engineering subjects: aeronautical, chemical, civil, electrical, highway, hydraulic, mechanical, mining and petroleum engineering.

Examinations will be held throughout the country on Oct. 8.

Calendar

Annual Meetings

AMERICAN SOCIETY OF SANITARY ENGINEERING, New York City; Annual Convention, Philadelphia, Pa., Sept. 9-12, 1924.

CITY MANAGER'S ASSOCIATION, Lawrence, Kansas; Annual Meeting, Montreal, Que., Sept. 23-25, 1924.

AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS, St. Petersburgh, Fla.; Annual Convention, Boston, Mass., Sept. 29-Oct. 3, 1924.

NEW ENGLAND WATER WORKS ASSOCIATION, Boston, Mass.; Annual Meeting, Rochester, N. Y.; Sept. 30 to Oct. 3.

AMERICAN CONSTRUCTION COUNCIL, New York City; Annual Meeting, New York City, Oct. 2-3, 1924.

AMERICAN PUBLIC HEALTH ASSOCIATION, New York City; Annual Meeting, Detroit, Mich., Oct. 20-23, 1924.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; Fall Meeting, Detroit, Mich., Oct. 23-25, 1924.

AMERICAN ROAD BUILDERS ASSOCIATION, New York City; Annual Convention, Chicago, Ill., Jan. 5-9, 1925.

AMERICAN CONCRETE INSTITUTE, Detroit, Mich.; Annual Meeting, Chicago, Ill., Feb. 24-27, 1925.

The Montreal Branch of the Engineering Institute of Canada at its luncheon meeting, Sept. 25, will be addressed by Sir Ernest Rutherford, English physicist, who was a resident for many years in Montreal.

Personal Notes

GEORGE R. WINSLOW, Sacramento, Calif., who has been appointed assistant highway engineer in charge of maintenance for the California State Highway Commission was for several years engineer of Division 3 with headquarters in Sacramento. His place as division engineer will be taken by F. W. HASELWOOD, a member of the bridge department of the highway commission.

ALBERT H. JEWELL, Lawrence, Kan., has resigned from his positions as associate professor of sanitary engineering of the University of Kansas, director of the water and sewage laboratory of the Kansas State Board of Health, and chief engineer for this board, to become executive secretary for the Health Conservation Association of Kansas City, Mo., with office at 408 Hall Building, that city.

MARSHALL K. WHITE, assistant city engineer of San Mateo, Calif., has been named acting city manager, pending the appointment of a permanent official. The office is vacant due to the resignation of C. F. PRICE.

THOMAS C. HIGGINS, who is now employed as engineer for James H. Kerr, contractor, Rumford, Maine, was formerly engineer for the Sanders Engineering Co. of Portland, Maine.

MAX BUHLE, professor in Dresden Technical University and author of "Massentransport," is now in this country studying the development of American railways with particular reference to terminal and other transportation problems. He is especially interested in mechanical means of handling bulk and package cargo. The collection of facts and data which he is making is for the purpose of a study of present-day transportation facilities as compared with facilities at the time of his last visit to this country. Professor Buhle expects to travel over the greater part of the country visiting large railroad terminals, ports, and manufacturing plants, and will appreciate the courtesy of an opportunity to study as many of such plants as is possible in the time at his disposal. He would also like to receive descriptive pamphlets on literature concerning the equipment used in the mechanical handling of material in terminals and warehouses, so that the new edition of Massentransport which he is preparing will be as complete as possible in so far as it applies to American methods. He may be addressed c/o Thomas Prosser & Sons, 15 Gold St., New York, N. Y.

A. WESTENBERG, Marshfield, Wis., has been engaged as city engineer for Marshfield.

COLONEL WILLIAM G. ATWOOD, consulting engineer, formerly director, Committee on Marine Piling Investigations, National Research Council, announces that his office for consulting practice is now located at 50 Church St., New York City, where he will be available for consultation on materials of construction, design and operation of harbor and railway terminal facilities, and problems in transportion design, operation and economics, both domestic and foreign.

MAJOR WILLIAM E. R. COVELL, Corps of Engineers, has been ordered to report to Major J. Franklin Bell, engineer commissioner of the District of Columbia, for duty as his assistant. At present Major Covell is assisting Lieut.-Col. Henry C. Jewett, chief of the military division of the office of the Chief Engineers, in special charge of the personnel section. Major Covell is 32 years of age. Soon after graduation from West Point, he was assigned to the Corps of Engineers. Later he graduated from Massachusetts Institute of Technology and the Army Engineer School. In service in France as lieutenant-colonel he commanded the 2nd Engineers. On return to this country he was in charge of river and harbor work at Buffalo, N. Y., until his transfer a few months ago to the office of the Chief of Engineers.

L. S. PARISEAU has been appointed by the Department of Railways and Canals to be superintending engineer of the canals of the Province of Quebec succeeding Col. Dubuc; headquarters are at Montreal.

COL. EDWARD N. JOHNSTON, U. S. Army engineer, has been appointed chief consulting engineer on the harbor development program of Long Beach, Calif. Col. Johnston's contract will extend over a period of five years, and he will receive, besides his salary, one per cent of the cost of all work.

SAMUEL FORTIER has been appointed consulting professor of irrigation investigations and practice in the College of Agriculture of the University of California. As associate chief of the Division of Agricultural Engineering, U. S. Department of Agriculture, with headquarters at Berkeley, Calif., he is in direct charge of all the irrigation interests of the department west of the Missouri River. Mr. Fortier is an alumnus of McGill University and has held various important technical appointments in the United States, both public and private, during the past forty years, and has published numerous books and articles on irrigation subjects. Between 1912 and 1915 he was advisor to the government of British Columbia on irrigation law and consulting irrigation engineer for the Canadian Pacific Ry.

P. J. MORANTI, H. N. RAYMOND and W. A. BABSON are the directors and subscribers of Moranti & Raymond, Inc., a newly-incorporated firm of contracting engineers of New York City.

BENJAMIN A. SLEEPER, city engineer, of Burlington, N. J., has been appointed engineer for Northampton township, Burlington County, N. J. He succeeds B. Harold Wills, of Mount Holly, N. J., who has become an engineer for the U. S. Cast Iron Pipe and Foundry Co., of Burlington.

Obituary

COL. ALBERT HILAND ACHER, since the war president of the Bergendahl & Acher Co., contractors, Chicago, died at Lake Forest, Ill. Aug. 26. Born in 1885 he was graduated from West Point in 1909, the Army Engineering School in 1911 and was assigned as assistant engineer and head of the fortification division of the Panama Canal. During the war he was in turn colonel, 4th Engineers; chief engineer, 4th Division; colonel, 102nd Engineers; chief engineer, 27th Division, duty with Peace Commission to Paris and head of mission to Italy; special adjuster, Liquidation Commission, Paris; Fortification Section Office, office, Chief of En-

gineers, Washington, D. C. and chief engineer, U. S. Food Products Corporation. He received the distinguished service medal and was cited for gallantry for constructing bridges over the Vesle River under fire. Colonel Acher was a member of the American Society of Civil Engineers and the Chicago Engineers Club.

AUGUST BEHRENS, retired construction engineer, died Aug. 24 at the home of his daughter, Mrs. Hugo Schulte, in Westfield, N. J. Mr. Behrens was 66 years of age, was born in Germany and educated at Hamburg University. Before coming to America, 29 years ago, Mr. Behrens had done considerable construction work on the island of Samoa; it is said he was the first white man on the island.

SAMUEL M. BROOKFIELD, noted contractor and builder of Halifax, N. S., died Aug. 22 at his home in that city, aged 76 years. Mr. Brookfield's father, a civil engineer, after having canalized the River Shannon in 1845, came to Canada and built a railway from St. Andrews, New Brunswick, inland. He later built forts, docks and government buildings for the British government. Samuel Brookfield continued the construction business and built many of the important government and other buildings in Nova Scotia, New Brunswick and Newfoundland. In the 80's he constructed the Halifax graving dock, one of the first in North America, an all-concrete dock 675 ft. long, 70 ft. wide, in sea water, and subject to severe climate, which is in good preservation today, the iron pontoon also being in good condition. He organized the first hydro-electric power scheme for the city of Halifax. Mr. Brookfield was director of many companies, president of the Halifax Power Co. and of the Maritime Telegraph and Telephone Co.

MARK H. PLACE, secretary and chief executive, Civil Service Commission, Milwaukee, Wis., was drowned Aug. 28 in Lake Koshkonong, near Milton, Wis. Following graduation from Milton College he attended Massachusetts Institute of Technology from which he received a degree in 1906. After a time as editor in Laramie, Wyo., succeeding Bill Nye, the humorist, as editor of *The Boomerang*, he worked as civil engineer with the Chicago, Milwaukee & St. Paul Ry. until 1919 when he became interested in civil service work.

JOHN A. MCRAE, railroad contractor, died at his home in Port Huron, Mich., on Aug. 17. Mr. McRae was born in the province of Quebec, near Montreal, and was in his 94th year at the time of his death. His early railroad construction contracting included work on 200 miles of the Southern Pacific in Texas, 100 miles of the Canadian Pacific in northern Ontario, and considerable double-tracking work on the Grand Trunk between Sarnia and Montreal. In 1898 he worked on the water-works tunnels for the city of Chicago. His final contract, completed when he was 76 years old, was the construction of 40 miles of the Temiskaming & Northern Ontario Ry.

From the Manufacturer's Point of View

A Point of Contact Between Maker and User of Construction Equipment and Materials

Engage Exhibit Space at Water Works Equipment Show

Applications from twenty-eight companies had been received up to Aug. 28 for exhibit space at the annual convention of the New England Water Works Association, to be held in Rochester, N. Y., Sept. 30-Oct. 3. J. E. O'Leary, chairman of the Exhibit Committee of the Water Works Manufacturers' Association, reports reservations by the following:

Neptune Meter Co.
Lap Joint Impervious Pipe Co.
"Fire and Water Engineering"
Thomson Meter Co.
Geo. A. Caldwell Co.
Union Water Meter Co.
Central Foundry Co.
"American City"
Kennedy Valve Mfg. Co.
Water Works Equipment Co.
Pitometer Co.
Builders Iron Foundry.
Red Hed Mfg. Co.
National Meter Co.
Lead Lined Iron Pipe Co.
"Engineering News-Record"
National Tube Co.
Hays Mfg. Co.
McWane Cast Iron Pipe Co.
Hersey Mfg. Co.
Lock Joint Pipe Co.
Paradon Eng'g. Co.
Eddy Valve Co.
R. D. Wood & Co.
Wallace & Tiernan Co., Inc.
Pittsburgh Meter Co.
Pittsburgh-Des Moines Steel Co.
"Engineering & Contracting"

Power Show in December

The third annual National Exposition of Power and Mechanical Engineering will be held in the Grand Central Palace, New York, Dec. 1-6, simultaneously with the annual meetings of the American Society of Mechanical Engineers and the American Society of Refrigerating Engineers. At the present time the show has twice the requests for space that the previous show in New York had at a corresponding time last year.

D. J. Reagan Appointed Trade Commissioner of Paris

Dr. Julius Klein, director of the Bureau of Foreign and Domestic Commerce, has announced the appointment of Daniel J. Reagan of Terre Haute, Ind., as trade commissioner to Paris, France. Mr. Reagan, who is a graduate of Columbia University, has been connected with the Bureau of Foreign and Domestic Commerce for the past year and a half as editor of the *Commerce Year Book*. Prior to his association with the bureau he served successively with the Hocking Valley Products Co., as plant superintendent, with the International Commercial Co., general export and import corporation, with the Raymond Engineering Corporation, New York, in charge of plant organization and equipment purchases, and with the McGraw-Hill Co., Inc., New York, publisher of *Engineering News-Record* and other engineering journals, as advertising specialist and market investigator. Mr. Reagan will sail for his new post in the early part of September.

Too Many Odd-Size Doors, Millwork Companies Claim

Likelihood of early surveys leading to a reduction in the types and sizes of doors manufactured by the millwork industry was indicated last week by the Division of Simplified Practice, Department of Commerce. Suggestions for such action have come within the last few days to the division from two important sources, one the Southern Sash, Door and Millwork Manufacturers' Association, and the other a big manufacturing company in Tacoma, Wash.

"We are wondering," wrote this firm, "if some action could not be taken in the stock door industry to eliminate many needless types and sizes of doors which the manufacturers are called upon to make. . . . There are certain standard types and sizes of doors which constitute the bulk of the doors manufactured in stock factories. There are, however, many customers who order a stock pattern, but who insist on some slight deviation, usually for no better reason than the fact that they have always received them in this way before. . . .

"We are confident that the stock door factories in this section would welcome some effort to simplify the business. . . . We also believe that the distributors and dealers in sash and doors would be in favor of such a movement."

Indications have shown that Southern dealers in this commodity are heartily in favor of a simplification of sash, doors and millwork generally; and the subject is being investigated in other sections of the country to ascertain the reactions of the distributors and dealers, the division reported.

Paving Brick Shipments Advance

Shipments and production of vitrified paving brick for the month of July showed increases of several millions while stock on hand and unfilled orders showed declines as compared with the month of June, according to the monthly statistical report of the National Paving Brick Manufacturers Association. Twenty-four companies representing 62 per cent of the total tonnage capacity of the industry report operations for the month at 81 per cent of their normal monthly capacity.

Production for July was 31,452,000 brick as against 24,998,000 for June. Shipments were 31,300,000 for July and 27,786,000 for June. Stock on hand was 110,286,000 the last day of July as against 111,637,000 the last day of June. Unfilled orders declined from 99,314,000 the last day of June to 92,237,000 the last day of July.

Ohio led all states in consumption for the month, closely followed by Kansas, Illinois and Pennsylvania.

Manufacturer Holds School for Distributors' Salesmen

Through the medium of a 3-day school at its works in Indianapolis the Link-Belt Co. last month inaugurated a plan of acquainting representatives of the distributors of its products with manufacturing procedure and company policy and personnel. In the past it has not been unusual for manufacturers to hold office and factory schools for their own salesmen or to send representatives to the headquarters of jobbers or distributors for purposes of contact. The recent Link-Belt school, however, represents a departure from the practices just cited in that the equipment distributors assembled for conference and inspection trips at the plant of the manufacturer.

Twenty-one representatives of 14 equipment distributors attended the school at Indianapolis, Aug. 25-27, under the direct supervision of George Torrence, sales manager of the Link-Belt Co., assisted by S. L. Haines of the company's Philadelphia works, and Walter Ostrand, of the Chicago plant. The school was concluded with a banquet at the Country Club when addresses were made by Alfred Kauffmann, president, and other officials of the company. It is planned to make the distributors' school an annual affair.

Business Notes

HOLT MANUFACTURING CO., Stockton, Calif., announces the appointment of the Holt Texas Equipment Co., Inc., 217 S. Market St., Dallas, as distributor for caterpillar tractors in Texas. R. S. Lowe, Dallas, is president of the company, newly formed as successor to the previous distributor, Holt Co. of Texas, Inc.

STANLEY B. DELONG has been appointed general manager of manufacture for the American Radiator Co., New York, succeeding the late R. L. Redpath. Mr. DeLong has been with the company for many years in various capacities, his most recent position having been that of director of radiator manufacture.

PAWLING & HARNISCHFEGER CO., Milwaukee, has appointed P. H. Sackett, 3445 Hennepin Ave., Minneapolis, as its representative in Minnesota, North and South Dakota.

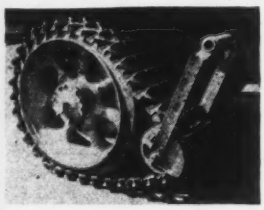
GIBB INSTRUMENT CO., Bay City, Mich., manufacturer of electric welding equipment, has appointed D. A. Clements as its representative in Missouri and Southern Illinois; his headquarters will be at 4167 Washington St., St. Louis, Mo.

H. L. WOOLFENDEN, until recently district manager at the Denver office of the Allis-Chalmers Manufacturing Co., Milwaukee, has joined the Scott Valve Manufacturing Co., Detroit, where he will have charge of sales promotion.

Equipment and Materials

Crawler Attachment for Motor Truck Wheels

Built in sizes to fit all standard tires, both solid and pneumatic, for motor trucks of 2 tons capacity or more, a continuous crawler tread attachment called the Truk-Trak has been placed



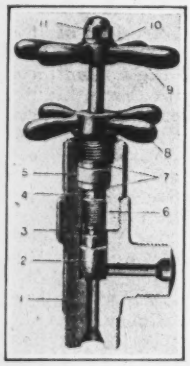
on the market by the Silver Casting Co., Milwaukee. It is designed to facilitate the operation of motor trucks over the soft or sandy ground frequently encountered on construction work.

The device consists of an endless belt of steel shoes operating over the rear truck wheel and an idler, as shown in the accompanying illustration. A uniform tension on the track is insured by a second idler.

When the truck is operating over hard ground the crawler attachment is removed and carried on reels fastened to the body, while the idlers and hangers are swung out of the way. The Truk-Trak attachment, the manufacturer states, can be installed by one man in about 20 min. In addition to providing traction over soft ground, the attachment is recommended by its maker for traversing snow-covered routes.

Valve for Oxygen Manifold

What is claimed to be a fool-proof valve for a high-pressure oxygen manifold, forming part of the equipment for welding and cutting operations, has been developed by the Oxweld Acetylene Co., New York. If the operator should happen to unscrew the hand wheel all the way there is no possibility of the internal parts being blown out by pressure, because the stem screws into the stuffing box. Even if he should unscrew both the stem and the hand wheel the parts could not come out because the large end of the stem would lodge against the inner end of the stuffing box.



The valve has a swivel tip on the stem. The cross-sectional illustration shows the details of its construction and operation. The body (1) has a formed seat receiving the stem tip (2). This tip is attached to and carried by the stem (4), by means of a swivel joint. Thus, the tip is enabled to seek its own natural seat in the body. The stem screw is in the inner end of the stuffing box (6), which is made gas tight into the body by means of the lead gasket (3). The stem itself is made gas tight by the rubber packing (5), which is compressed between packing rings (7), by means of the hand wheel and nut (8).

Machine Cuts Grade for Thickened-Edge Pavement Slab

For shaping subgrade to the proper contour for the new thickened edge cross-section of concrete pavement slabs called for in the specifications of a number of state highway departments, Edward G. Carr, 224 West Huron St., Chicago, has brought out a device called the Formgrader. It consists of a four-wheel chassis powered by a Ford automobile engine and equipped with a rotary cutter, a detail of which is shown in one of the accompanying illustrations. The equipment is designed to cut a form trench up to 1 ft. deep and 1 ft.

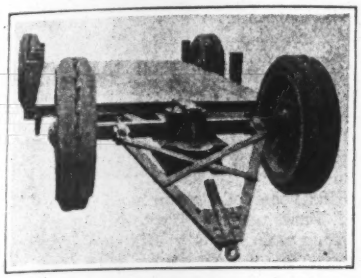
wide, as well as the slope up on the inside. In one trip the machine makes a cut 1 ft. wide and 6 in. deep.

The depth of cut by the rotary cutter, which is mounted immediately in front of the large rear wheel of the machine, is controlled by a hand-wheel and a gage running with hair spring pressure against a taut guide line at proper grade. The gage is actuated by a pendulum so that any tilting of the machine does not cause a variation in the grade cut below the line. The machine has working speeds of from 7 to 15 ft. a minute, and a traveling speed of 3 miles an hour. It not only cuts the subgrade to the right height for supporting the forms, but it also rolls down soft ground where the forms are to be set.

The machine illustrated is on the Duncan Construction Co.'s state-aid road job at Champaign, Ill., where a 9-ft. pavement is being laid at a rate of from 1,000 to 1,400 ft. a day. The Formgrader, it is reported, has replaced the crew formerly employed to dig the form trench, and by cutting out the shoulder next to the form has aided the operation of subgrading.

Transport Trailer for Power Shovel

For moving small revolving power shovels and other types of contractors' equipment from one job to another the Bucyrus Co., South Milwaukee, Wis., has placed on the market a four-wheeled, rubber-tired transport trailer designed for haulage by a motor truck or tractor. The trailer is recommended



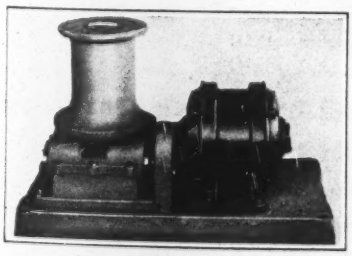
for hauling all classes of contractors' equipment weighing up to 30 tons. The loading clearance is 120 in.

This trailer is built for heavy duty; the front axle is 4 x 4 in. high carbon steel, heat treated, and the rear axle is 6 x 4 in. and of the same material. The wheels are provided with Timken roller bearings and are of artillery type, and have oil-tight housings requiring lubrication only once a year. The front wheel tires are 12 in. and the rear tires 14 in.; these are special heavy-duty cushion tires that absorb road shocks and furnish cushioning action under varying loads.

The platform is constructed of 4-in. long-leaf, yellow pine, and its edges are protected all around by steel angle irons. The platform is supported by a framework composed of 8-in. steel I-beams, which is anchored to a heavy steel bridge casting at the front end and is reinforced at the rear end with a 10-in., 30-lb. steel cross channel. The construction provides a three-point suspension.

Electric Capstan Car Puller

For spotting and moving freight cars at construction jobs, warehouses, terminals, lumber yards and manufacturing plants, the Silent Hoist Co., Brooklyn, N. Y., manufactures a one-man electric capstan car puller. The equipment, consisting of a vertical capstan



winch and a high-torque electric motor, is mounted on a fabricated steel I-beam base occupying a ground area of 22 x 44 in. The complete unit weighs 750 lb. with a.c. motor and 950 lb. with d.c. motor. The machine produces a drawbar pull of 5,000 lb. at 25 ft. per minute and pulls at a speed of about 50 ft. per minute when the cars are under way. The car puller, the manufacturer states, will easily move two loaded freight cars.

The capstan is driven by a phosphor bronze worm wheel meshing with a nickel steel worm, the thrust being taken up by a ball bearing running in oil in an inclosed gear case. Removable phosphor bronze bearings are used throughout. The winch head is machined and polished to prevent wear on the rope and is fitted with a bronze cover plate. To protect the equipment from the weather a sheet metal housing is furnished inclosing the motor and starter.

The company also manufactures another model of capstan without motor for mounting on a motor truck and, where electricity is not available, the capstain may be driven by a multi-cylinder gasoline engine.

Sensitive Control of Power Shovel Mechanism

To facilitate the shifting of clutches and eliminate steam or air ram control of power shovel operation, the Northwest Engineering Co., Chicago, has introduced a new and sensitive mechanism known as the feather-touch lever control, which, it is claimed, enables the operator to "feel" the effort needed

in guiding the movements of his machine. The lever control feature is applied to the end of the drum shaft and actuates the clutch shifter rod which is concentric with the drum shaft and contained in a drilled hole within it. The clutch shifter rod moves back and forth, the inner position being engagement and the outer position disengagement.

A small drum is keyed on the drum shaft and moves in the same direction; a clutch band is wrapped about this drum and co-acts with it. The operation of the device is based on the physical law that there is a definite ratio between the two ends of a clutch or brake band which is wrapped externally to a moving drum depending on the arc of contact and the coefficient of friction of the brake lining to the co-acting surface.

Thus if the ratio has a value somewhere between 3 and 5 and 100 lb. of pressure is applied to the end of the band toward which the drum rotates by means of the control lever and intermediate linkage and the opposite end of the band is used to throw the clutch, the amount of effort necessary will be reduced from $\frac{1}{3}$ to $\frac{1}{5}$ of that necessary to throw the clutch by hand.

Action of the lever opposite to that necessary to engage the clutch disengages it. Whereas the throwing of the clutch is accomplished by means of the small band, disengagement is absolutely positive so even though the clutch may be engaged "by center" sure release is always obtained.

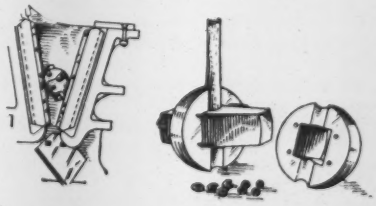
Asphalt Filler Cushions Rail Against Pavement

A rail filler described as a specially tempered asphalt composition which acts as a resilient cushion between rail and pavement, absorbing traffic impact, rail vibration and traffic noise, has just been placed on the market by the Philip Carey Co., Cincinnati. It comes to the job preformed to fit any rail section and is readily shaped to fit any track curve.

The new Elastite rail filler is made to extend a short distance beyond the rail itself, so that the paving is laid not against the steel rail but against the filler, being thus cushioned against impact with the rail. In installing the filler the only tool needed is a mallet.

Safety Hammer Guard to Protect Rock Crushers

To prevent damage to a rock crusher when a stone hammer accidentally drops between its jaws the Road Builders Equipment Co., Portland, Ore., has devised a safety hammer guard in the form of a pair of rubber hemispheres which are slipped over the ends of the hammer, drawn together and held in place by four bolts, as shown in the accompanying illustration. When equipped with this guard a hammer falling into the crusher is prevented



by the rubber sphere encasing it from reaching a point where the crusher jaws will close on the metal of the hammer. Instead, the jaws bite harmlessly on the rubber.

Business Side of Construction

FACTS AND EVENTS THAT AFFECT COST AND VOLUME

More Building Permits Issued This Year Than Last

Value 89 Million Ahead of Jan. to July, 1923—Drop In New York and Chicago During July

That there is no evidence of depression in the construction industry is claimed in a report of the National Association of Building Trades Employers, dated Aug. 20, 1924.

This analysis is based upon the total value of building permits issued in twenty typical cities and does not apply to contracts awarded.

While there was a gain, during the first seven months of the current year, of $89,000,000 over the corresponding period in 1923, the figures for July, 1924 were $31,000,000 under those of the month preceding. This deficit is entirely due to declines in New York and Chicago, according to the Association. The report, in part, follows:

"What is the status of the construction industry? This is an important question right now, especially in view of the fact that in many lines of industry, business so far this year falls far short of that of last year. Another important factor to be considered is the bearing that construction has on business conditions generally, inasmuch as it is the second largest industry in the country.

"The question may best be answered by a careful analysis of conditions in a number of widely scattered communities and for the purpose of comparison, twenty typical cities are taken, representing the various sections of the country.

July Decrease 31 Million

"Building permits issued in these twenty cities during July of this year amounted in round numbers to 139 million dollars, while the June valuation amounted to 170 million, a decrease of 31 million. However, New York and Chicago alone are responsible for this difference. Permits issued in the five boroughs of New York amounted approximately to 40 million dollars in July and 58 million in June. Chicago permits amounted to approximately 19 million dollars in July and 34 million in June. These two cities therefore are responsible for a decrease of 33 million dollars, which means that the total value of permits issued in the other eighteen cities was approximately the same for the two months.

"A study of figures for this same group of twenty cities over the first seven months of this year shows that the total value of permits issued exceeds that of last year for the same period by about 89 million dollars. If business keeps up during the last five months of the year, and there is every reason to believe that it will, the total volume will greatly exceed that of last year, which was a record breaker.

"The figures for July in twelve of the twenty cities show an increase over June, and the remaining eight show a decrease which with the exception of New York and Chicago is very slight. Over the longer period taking in the first seven months of the year, eleven cities show an increase over last year, and the other nine register a decrease. New York has the biggest gain in this period."

Large Contracts Let During Week

Among the week's announcements of contracts awarded in Construction News, pp. 127 to 138, are the following:

Library, Los Angeles, Calif., to Edwards, Wildey & Dixon, $1,350,000.

Hotel and Service, Chicago, Ill., to G. A. Fuller Co., and Krahl Constr. Co., $7,000,000.

Hotel, Huntington, W. Va., to Hancock Constr. Co., $1,000,000.

Bids Wanted on Big Jobs

Among the projects on which bids are either asked or will soon be called for in Construction News, pp. 127 to 138, are the following:

Old channel enlargement, 175-mi., by

(*Continued on p. 403*)

Lumber Bids Given On Wilson Dam Construction

Bids received on lumber for the Wilson Dam project, by the chief of the Government Supply Division at Florence, Ala., are compared in the accompanying tabulation.

The amounts bid in each case were considerably below the estimated cost. In three instances contracts were not awarded to the lowest bidders; the higher figures having involved more favorable delivery conditions.

BIDS RECEIVED ON LUMBER FOR WILSON DAM CONSTRUCTION IN THE TENNESEE RIVER

Bids Opened	Description of Material	Estimated Cost	Bids Received	Amount	Contract Awarded To	Amount
July 21	345,900 ft. structural timbers 3x10-in., 14, 16 and 20 ft., S4S	$6,000	C. D. Whitfield Co. Sheffield, Ala.	$5,000	C. D. Whitfield Co. 225 M ft., 3x10 in., 14 and 16 ft.	$5,000
			Rosemary Tie & Lumber Co. Jasper, Ala.	5,313	The Rosemary Tie & Lumber Co. 145,900 ft., 4x6 in., 16 and 20 ft. rough	3,157
July 21	343,500 ft., short leaf, Southern, yellow pine No. 1 common, 2x10-in., 12, 14 and 16 ft., S4S; 345,900 ft., timbers, No. 1 common, 3x10-in., 14, 16 and 20 ft. S4S	15,000	R. J. McCreary Lumber Co. Evergreen, Ala.	8,415	R. J. McCreary Lumber Co.	8,415
			C. D. Whitfield Lumber Co. Sheffield, Ala.	8,587		
			Nicola, Stone and Myers Hattiesburg, Miss.	8,931		
July 25	180 pcs. l.l. Southern yel. pine timber, 100 per cent heart, 12x12-in., 16 ft.	6,000	Bentley & Emery Ovett, Miss.	5,630	Bentley & Emery	5,630
			Chicago Lumber & Coal Co. St. Louis, Mo.	5,287		
	1200 pcs. yel. pine timber, No. 1 common, 12x12-in., 12 and 18 ft., 3x12-in., 14 and 16 ft.		R. J. McCreary Lumber Co. Evergreen, Ala.	5,264		
July 25	100,000 ft., short leaf, So. yel. pine, No. 1 common, 2x4-in., 12 and 16 ft.	.....	R. J. McCreary Evergreen, Ala.	2,700	Nicola, Stone & Myers	2,950
			Nicola, Stone & Myers Hattiesburg, Miss.	2,950		
			R. P. Powell Tuscaloosa, Ala.	2,725		
July 26	153,000 ft. short leaf, So. yel. pine, 2x6-in., 12, 14 and 16 ft.; 120,000 ft., 2x8-in., 12, 14 and 16 ft.; 204,000 ft.; 2x10-in., 12, 14 and 16 ft.; 68,000 ft., 2x12-in., 14 and 16 ft.	15,000	M. M. Elledge Co. Corinth, Miss.	13,165	M. M. Elledge Co.	13,165
			Clark Lumber Co. Jasper, Ala.	13,392		
			Cleveland Lumber Co. Jasper, Ala.	13,211		
July 27	360,000 ft. Virgin l.l. So. yel. pine, close grained, air dried, No. 1 common, 1x4-in., 12 ft., S4S; 2x6-in., 12, 14 and 16 ft.; 2x8-in., 16 ft., 2x10-in., 12 ft. S4S	5,000	C. G. Hull Lumber Co. Laurel, Miss.	3,944	C. G. Hull Lumber Co.	3,994
			Edmund Hines Yellow Pine Co. Birmingham, Ala.	4,161		
			Marsh & Truman Lumber Co. Chicago, Ill.	4,224		
July 28	309,000 ft. timbers, short leaf, So. yel. pine, No. 1 common, rough, 10x10-in., 14, 16 and 20 ft.; 10x12-in., 12 and 16 ft.	9,200	Marsh & Truman Lumber Co. Chicago, Ill.	9,130	Marsh & Truman Lumber Co.	9,130
			Cleveland Lumber Co. Jasper, Ala.	8,550		
			Rosemary Tie & Lumber Co. Jasper, Ala.	9,025		

August Construction Volume Greater Than Preceding Month And Same Period Last Year

Lettings Heaviest in Section Between Mississippi and Pacific Coast—Gains in Water-works, Sewers and Excavations

The total value of large contracts awarded during August, as published in the four issues of *Engineering News-Record*, reached $163,292,000. The contract total for the five issues of July, however, was $202,095,000.

The average weekly value of August lettings was $40,823,000, compared with $40,819,000 for July and $28,319,800 for August, 1923.

Minimum costs observed in the Construction News section of *Engineering News-Record* in each class of construction are as follows: Waterworks, and excavations, $15,000; other public works, $25,000; industrial construction, $40,000 and commercial buildings, $150,000.

August lettings were particularly heavy in water-works, sewers, excavations, drainage and irrigation projects. Marked gains in money value of contracts awarded occurred in that section of the country lying between the Mississippi River and the Pacific Coast. Canadian awards more than doubled during Aug. as compared with the month preceding.

The actual physical volume of August construction was 1½ per cent greater than that for the month preceding and 51 per cent heavier than August, 1923. The same volume of work was accomplished in August as in March of this year.

Among the large contracts let during August were the following projects: A hotel, Hollywood, Calif., $3,000,000; office building, Columbus, O., $3,000,000; apartment, Detroit, Mich., $2,500,000; bridge over the Willamette River, Portland, Ore., $2,370,473; club, Los Angeles, Calif., $2,200,000; printing plant and office, Detroit, Mich., $2,000,000; sewer, North Bergen, N. J., $1,596,000; sugar refinery, Crockett, Calif., $1,250,000; sewer, Jersey City, N. J., $1,147,110; railroad yards, L. & N. R. R., New Orleans, La., $1,000,000 and an amusement pier, Venice, Calif., $1,000,000.

Bids Wanted on Big Jobs

(*Concluded from p. 402*)

Little River Drainage District, Missouri, $4,000,000.

Club building, Los Angeles, Calif., for Los Angeles Lodge, No. 69, B. P. O. E., $1,750,000.

Medical arts building, Omaha, Neb., $1,000,000.

Engineering News-Record Construction Cost Index Number

September, 1924	211.25
August, 1924	213.15
September, 1923	221.50
Peak, June, 1920	273.80
1913	100.00

Jan., 1923	191.70	Nov.	220.90
Feb.	197.40	Dec.	217.30
Mar.	205.25	Jan., 1924	217.90
Apr.	213.50	Feb.	220.30
May	216.70	Mar.	224.70
June	220.70	Apr.	221.60
July	222.10	May	222.38
Aug.	221.50	June	216.85
Sept.	221.50	July	214.40
Oct.	220.30		

Engineering News-Record's Construction Cost Index Number declined 1.9 points since last month, owing to lower steel prices. The average rate for common labor is still 56c. per hr., against 55c. five months ago and 54c. in September, 1923. Thus general construction cost is 5 per cent lower than one year ago and 23 per cent under the peak; it is 111 per cent above the 1913 level.

Engineering News-Record Construction Volume Index Number

Monthly

August, 1924 *(4 issues of E. N.-R.)*	134
July, 1924 *(5 issues of E. N.-R.)*	165
August, 1923 *(5 issues of E. N.-R.)*	111

Yearly

1923 (entire year)	135
1922 (entire year)	130
1921 (entire year)	88
1920 (entire year)	91
1919 (entire year)	91
1918 (entire year)	80
1917 (entire year)	64
1916 (entire year)	97
1915 (entire year)	95
1913 (entire year)	100

Engineering News-Record's Conctruction Volume Index Number is 134 for the month of August, and 135 for the whole of 1923, as against 100 for 1913. This means that the actual volume of construction in 1923 (not the mere money-value of the contracts let that year) is 35 per cent above the volume of construction for 1913. Our monthly volume number, 134 for August, 1924, contains the increment of construction and indicates the rate at which contracts are being let as compared with 1913 awards.

VALUE OF CONTRACTS LET IN THE UNITED STATES AND CANADA DURING AUGUST, 1924

	New England	Middle Atlantic	Southern	Middle West	West of Mississippi	West	Total United States	Canada	Grand Total
Water-works	$179,000	$468,000	$313,000	$669,000	$4,639,000	$122,000	$6,390,000	$373,000	$6,763,000
Sewers	80,000	3,320,000	1,703,000	2,497,000	2,082,000	372,000	10,054,000	603,000	10,657,000
Bridges	388,000	346,000	759,000	1,588,000	920,000	3,217,000	7,218,000	57,000	7,275,000
Excavations, drainage, etc.	25,000	25,000	1,276,000		336,000	1,050,000	2,712,000		2,712,000
Streets and Roads	1,396,000	7,387,000	5,127,000	11,452,000	8,553,000	4,443,000	38,358,000	2,178,000	40,536,000
Industrial Building	840,000	1,040,000	140,000	3,987,000	1,590,000	2,365,000	9,962,000	340,000	10,302,000
Commercial Building	11,422,000	11,700,000	3,077,000	20,262,000	15,212,000	12,731,000	74,404,000	1,256,000	75,660,000
Federal Government	104,000	199,000	1,779,000	131,000	405,000	625,000	3,243,000		3,243,000
Unclassified	797,000	1,151,000	1,615,000	25,000	583,000	1,873,000	6,044,000	100,000	6,144,000
Total August, 1924	$15,231,000	$25,636,000	$15,789,000	$40,611,000	$34,320,000	$26,798,000	$158,385,000	$4,907,000	$163,292,000
July, 1924	15,296,000	70,646,000	27,811,000	50,847,000	22,747,000	11,932,000	199,279,000	2,816,000	202,095,000
June, 1924	10,095,000	44,983,000	12,779,000	31,947,000	22,205,000	22,992,000	147,001,000	8,139,000	155,140,000
3 mos. total	$40,622,000	$141,265,000	$56,379,000	$123,405,000	$79,272,000	$61,722,000	$504,665,000	$15,862,000	$520,527,000

Labor Rates and Conditions Throughout the Country

While employment in the manufacturing industries is less than 90 per cent of what it was a year ago and part-time schedules have greatly reduced the average weekly earnings of workers, the outlook for increasing industrial activity is better now than it was last month.

Reserve materials stocks, piled up during the heavy production period of 1923, have been affected by the recent curtailment of output at mills throughout the country. The upward trend in prices of wholesale commodities would indicate this.

Employment in the contruction industry, however, continues active in most of the large centers, despite the general impression that the 1922-24 building boom has expended its force.

While prices of building materials declined steadily from June to August of this year, there have been no recessions in the cost of labor. The common labor rate for pick and shovel men in construction operations remains at 56c. per hr. for the entire country. This rate has prevailed during the past five months.

Local conditions as reported to *Engineering News-Record* follow:

Baltimore—Conditions continue on a normal basis in all building trades.

Boston—Carpenters and common laborers unusually plentiful.

Dallas—Surplus of pile drivers and

CURRENT BUILDING TRADES WAGE RATES PER HOUR

(Higher rates indicated by +, decreases by —)

Cities	Bricklayers	Carpenters	Hoisting Engineers	Hod Carriers	Pile Drivers	Structural Iron Workers	Common Labor
Atlanta	$1.12½	$0.70	$0.70	$0.50	.....	$0.75	.50@.50
Baltimore	1.75	.90@1.20	1.00@1.12½	1.00	$0.65	1.12½	.40
Birmingham	1.00@1.50	.25@.75	.75@1.00	.35@.45	.....	1.00	.25@.40
Boston	1.25	1.00@1.10	1.25@1.35	.82½	1.05	+1.25	.55@.75
Cincinnati	1.50	1.20	1.20	.92½	1.20	1.20	.55
Chicago	+1.50	1.15@1.25	1.00@1.25	.88¾	1.25	1.25	.82½@.87½
Cleveland	1.50	1.25	1.25	.87½	1.00	1.37½	.87½
Dallas	1.50	1.00	1.00	.40@.75	.87½	1.00	.30@.50
Denver	1.62½	1.12½	1.12½@1.18¾	.81¼@.87½	1.00	1.15⅝	.35@.55
Detroit	1.50	.90@1.00	.85@1.00	.90	.85@1.00	1.12½	.60@.75
Kansas City	1.37½	1.25	1.00@1.25	.90	1.00@1.12½	1.00	.40@.65
Los Angeles	1.25	—.87½	1.00	—.87½	.87½	—.85	.50
Minneapolis	1.12½	.87½	.87½	.71⅔	.....	.87½	.50@.55
Montreal	1.00	.65	.62½	.45	.50	.65	.25@.30
New Orleans	1.25	.90	1.00	.65	.80	1.00	.35@.40
New York	1.50	1.31¼	1.50	1.00	1.00@1.12½	1.31¼	.62½@.75
Philadelphia	1.50	1.12½	1.02½	1.12½	1.00	1.12½	.40@.45
Pittsburgh	1.55	1.37½	—1.12½	1.00	.....	1.37½	.70
St. Louis	1.75	1.50	1.50@1.67½	1.15@1.25	1.25	1.50	.45@1.10
San Francisco	1.25	1.00	1.00	.81¼	1.00	1.12½	.50@.55
Seattle	1.25	1.00	1.00@1.12½	.93¾	1.00@1.12½	1.12½	.62½

common laborers; plenty in other trades.

Denver—Building trades about 75 per cent employed.

Detroit—Curtailed activities in factories and shops have made labor more plentiful in the construction field.

Los Angeles—Abundant supply of building trades mechanics. General increase in building along the Pacific coast.

Montreal—Slight scarcity of structural iron workers. Other trades plentiful.

New York—Glaziers granted increase of 50c. per day making the present scale $10.50. Ironworkers and hoisting engineers are the only trades engaged at present in wage controversies with employers. Plasterers still scarce; enough bricklayers available.

Philadelphia—Greater volume of building projected than at this time last year. Total of permits near record month of March, 1923.

Pittsburgh—Labor plentiful in all lines.

San Francisco—Building still active in both commercial and residential work.

St. Louis—Electricians who went on strike Aug. 1, have returned to work at old wage scale of $1.50 per hr., effective until July 15, 1925.

Monthly Prices of Construction Materials

Ups and Downs of the Market

Prices Show Slight Excess of Advances Compared With Month Ago—General Trend Downward During Summer With Labor Higher

Pig-Iron—Prices firmer than at any time since the middle of August. Demand still slow in Birmingham district, with buying confined to small tonnage lots. No. 2 fdry. Southern is $18, against $25@$27 per ton at this time last year.

Railway Supplies—Minimum on light rails down $1 per ton since Aug. 7. Standard rails, however, are more active in demand than any other item on the steel list. Standard spikes are considerably lower at Pittsburgh mills and San Francisco warehouses.

Pipe—Wrought pipe holding firm at present levels. Tendency downward in c.-i. pipe at Pittsburgh, St. Louis and San Francisco, although bookings are particularly heavy in the Chicago district. Line pipe demand is active. Clay drain tile showing firmness in the South. Sewer pipe up in Los Angeles, Detroit and other points.

Road and Paving Materials—Asphalt firmer in Baltimore and St. Louis. No further rise in road oils although road contracts continue to increase. Granite paving blocks up $5 per M. in Boston during month.

Sand, Gravel and Crushed Stone—While there have been few changes in sand and gravel prices during August, considerable firmness in concrete aggregates has developed in New York.

Lime and Cement—Prices fairly steady in both materials. Of forty-six cities reporting regularly to *Engineering News-Record*, only three showed changes in cement prices during the month; two of the three instances were advances. With lime, the advances balanced the declines.

Brick and Hollow Tile—Common brick dropped $3 in New York and $6 per M. in Chicago since Aug. 7. A slight decline also occurred in Boston. In Minneapolis, however, an increased demand resulted in a rise of $1 per M. Trend of tile prices is upward.

Structural Steel—Considerable improvement is evident in the steel market compared with conditions existing one month ago. Rails and structurals lead in demand. Buying is better in bars, sheets and strip steel. Quotations on principal hot-rolled products are: bars, $2.10@$2.15; shapes, $1.95@$2.15 and plates, $1.70@$2 per 100 lb., Pittsburgh. Plates show greatest weakness compared with Aug. 7 levels.

Rivets and nails are cheaper than a month ago, although improvement is reported in demand for wire nails.

Lumber—Demand is fully as heavy as it was a year ago. During the past week, however, some falling off in orders was reported. Pine is higher in New York and Philadelphia and in larger sized timbers in Chicago; Boston, Atlanta and Kansas City report declines. Advances in hemlock and fir occurred in Boston; and in spruce and fir in Denver since Aug. 7, due to increasing local demand. Unusually heavy supply caused a price drop in Douglas fir in San Francisco. Common pine boards, roofers, shiplap and better grades of flooring show improvement in demand.

Iron and Steel Scrap—Heavy melting steel up $1 per ton f.o.b. New York. No change in other items.

Paint Materials—Red and white lead are ½c. per lb. above the Aug. 7 levels. Raw linseed oil is $1.07 per gal. f.o.b. New York in 5 bbl. lots, against $1.05 last month and 96c. per gal. one year ago. Paint demand, particularly for outside work, is heavier than during the summer of 1923.

Price advances since last month are indicated by **heavy type**; declines by *italics*

PIG IRON—Per Gross Ton—Quotations compiled by The Matthew Addy Co.:

	Sept. 4	One Year Ago
CINCINNATI		
No. 2 Southern (silicon 2.25 @ 2.75)	$22.05@22.55	$29.05@31.05
Northern Basic	20.00	28.17
Southern Ohio No. 2 (silicon 1.75 @ 2.25)	21.77	28.27
NEW YORK, tidewater delivery		
Southern No. 2 (silicon 2.25 @ 2.75)	28.05	34.37
BIRMINGHAM		
No. 2 Foundry (silicon 2.25 @ 2.75)	*18.00*	25@27
PHILADELPHIA		
Eastern Pa., No. 2X (2.25@2.75 sil.)	22.77@23.27	29.16
Virginia No. 2 (silicon 2.25 @ 2.75)	28.44@29.44	32.17
Basic	20@21	26.16
Gray Forge	21@22	26.16
CHICAGO		
No. 2 Foundry Local (silicon 1.75 @ 2.25)	20.00	28.61
No. 2 Foundry Southern (silicon 2.25 @ 2.75)	28.05	30.51
PITTSBURGH, including freight charge from the Valley		
No. 2 Foundry Valley (silicon 1.75 @ 2.25)	25.00	27.77
Basic	25.00	26.77
Bessemer	**28.66**	28.77

SCRAP—The prices following are per gross ton paid to dealers and producers f.o.b. New York. In Chicago the quotations are per net ton and cover delivery at the buyer's works, including freight transfer charges.

	New York	Chicago	Birmingham
No. 1 railroad wrought	$14.00	$11.50	10.00@11.00
Stove plate	10.00	12.00	14.00@15.00
No. 1 machinery cast	14.00	16.50	14.00
Machine shop turnings	8.00	4.00	6.00@7.00
Cast borings	9.00	5.50	8.00@9.00
Railroad malleable	13.00	12.50	13.00
Re-rolling rails	14.00	13.00	15.00@16.00
Re-laying rails	22.00	30.00	23.00
Heavy melting steel	**11.50**	.....	.....

RAILWAY SUPPLIES

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots. For less than carload lots 5c. per 100 lb. is charged extra:

	Pittsburgh				
	Sept. 4	One Year Ago	Birmingham	Chicago	St. Louis
Standard bessemer rails	$43.00	$43.00	$43.00	$43.00	$46.00
Standard openhearth rails	43.00	43.00	43.00	43.00	46.00
Light rails, 8 to 10 lb.	*37@38*	45.00	2.00*	40.00	*2.45**
Light rails, 12 to 14 lb.	*37@38*	45.00	2.00*	40.00	2.45*
Light rails, 25 to 45 lb.	*37@38*	45.00	2.00*	40.00	2.35*
Rerolled Rails	*27@35*	.....	.....	36.00	2.10*

*Per 100 lb.

RAILWAY TIES—For fair-sized orders, the following prices per tie hold:

	6 In. x 8 In. by 8½ Ft.	7 In. x 9 In. by 8½ Ft.
Chicago, White Oak	‡$1.45	$1.70
Chicago, (creosoted) (zinc treated)	1.85	2.10
San Francisco..... Green Douglas Fir	.84	1.14
San Francisco, Empty Cell Creosoted, Douglas Fir	1.70	2.25
St. Louis, White Oak	1.25	1.45
St. Louis (creosoted) (zinc treated)	1.65	1.90
St. Louis, Red Oak, plain	1.15	1.35
St. Louis, Sap pine-cypress	1.00	1.20
Birmingham, white oak	1.25	1.50

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh					
	Sept. 4	One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅝-in. and larger	*$2.80*	$3.15	$3.65	$3.75	*$4.35*	$3.72
Track bolts	3.75	4.00@4.25	4.65	4.65	5.85	4.57
Standard section angle bars	2.75	2.75	3.40	3.35	4.00	3.20

PIPE

WROUGHT PIPE—The following mill discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

BUTT WELD

Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
⅛ to 3	62	50½	1 to 1¼	30	13

LAP WELD

2	55	43½	2	23	7
2½ to 6	59	47½	2½	26	11
7 and 8	56	43½	3 to 6	28	13
9 and 10	54	41½	7 to 12	26	11
11 and 12	53	40½			

BUTT WELD, EXTRA STRONG, PLAIN ENDS

⅛ to 1¼	60	49½	1 to 1¼	30	14
2 to 3	61	50½			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	53	42½	2	23	9
2½ to 4	57	46½	2½ to 4	29	15
4½ to 6	56	45½	4½ to 6	28	14
7 and 8	52	39½	7 and 8	21	7
9 and 10	45	32½	9 to 12	16	2
11 and 12	44	31½			

WROUGHT PIPE—From warehouses at the places named the following discounts hold for steel pipe:

	Black			
	New York	Chicago	Birmingham	St. Louis
⅛ to 3 in. butt welded	48%	*56%*	61%	49%
2½ to 6 in. lap welded	44%	*53%*	58%	46%

	Galvanised			
	New York	Chicago	Birmingham	St. Louis
⅛ to 3 in. butt welded	34%	*43%*	50%	36%
2½ to 6 in. lap welded	30%	*40%*	48%	33%

Malleable fittings, Classes B and C, banded, from New York stock sell at list plus 4%, less 5%; class A, plus 23%. Cast iron, standard sizes, 34@5% off.

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	Birmingham Mill	Pittsburgh	New York Sept. 4	New York One Year Ago
4 in.	$53@54	*$64.50@65.60*	$65.60@66.60	$68.60
6 in. and over	50.00	*59.50@60.60*	60.60@61.60	63.60

	Chicago	St. Louis	San Francisco
4 in.	$61.20@62.20	*$55.60*	*$62.00*
6 in. and over	56.20@57.20	*51.60*	*58.00*

Gas pipe and Class "A," $5 per ton extra.

CLAY DRAIN TILE—The following prices are per 1000 lin.ft.:

Size, In.	New York Sept. 4	New York One Year Ago	St. Louis	Chicago	San Francisco	Dallas
3	$45.00	$45.00	$50.00	$50.00	.....	**$85.00**
4	55.00	55.00	50.00	60.00	$76.50	**110.00**
5	80.00	80.00	.....	90.00	97.75	**118.00**
6	105.00	105.00	85.00	100.00	127.50	**150.00**
8	170.00	170.00	195.00	200.00	212.50	**210.00**

SEWER PIPE—The following prices are in cents per foot for standard pipe in car load lots, f.o.b., except as otherwise stated:

Size, In.	New York Delivered	Pittsburgh	Birmingham	St. Louis	Chicago	San Francisco	Dallas
3	.....	$0.093	$0.105	.....	$0.17	$0.12	.....
4	....	.093	.10	$0.1175	.17	.15	$0.15
5	....	.1395	.14	.....	.26	.18	.18
6	$0.21	.1395	.165	.1645	.26	.21	.21
8	*.36*	.217	.265	.26	.41	.30	.325
‡10	*.53*	.3255	.385	.364	.61	.42	.476
12	*.68*	.4185	.46	.468†	.79	.54	.612
‡15	**1.14**†	.558	.655	.78†	1.04	.90	.102
18	1.65†	.775	.70	1.092†	1.45	1.32	1.53
20	**2.00**†	.93	1.40	.....	1.74	.....	.....
22	**2.65**†	1.24	1.68	1.456†	2.32	.....	1.564
24	2.97†	1.395	1.75	1.872†	2.61	2.16	2.04
27	*4.65*†	2.665	2.80	2.75†	3.77†	3.00	3.34
30	*5.16*†	2.952	....	3.40†	4.18†	3.60	4.06
33	**6.98**†	3.96	....	4.05†	5.22†	.....	4.99
36	**8.00**†	4.51	....	4.45†	5.95†	.....	5.42

	3	5	8	12	24	36
Boston	$0.13	$0.21	$0.32	$0.625	$2.00†	*$6.00*†
Minneapolis	.....	.....	.40	.72	2.55†	5.66†
Denver	.135*	.18*	.27	.47	1.70	.....
Seattle	**.14**	.....	*.35*	.72†	2.60†	.....
Los Angeles	**.1625**	**.195**	**.275**	**.495**	1.65	.....
New Orleans	.148*	.207*	.345	.586	1.182	.....
Cincinnati	.111	.1665	.259	.4995	1.665	4.92
Atlanta	.11*	.135*	.225	.3825	1.4625	.....
Montreal	.68‡	.45†	.70	1.35	4.50†	.....
Detroit	**.111**	**.1665**	**.259**	**.4995**	**2.43**†	**6.15**†
Baltimore	.117	.175	.273	.5265	1.755	5.125
Kansas City, Mo.	**.15**	*.21*	*.335*	.....	.....	.....
Philadelphia	.12	.18	.28	.54	1.80	4.61

*4-in., 6-in., 9-in., respectively. †Double Strength. ‡3-in. special.

ROAD AND PAVING MATERIALS

ROAD OILS—Following are prices per gallon in tank cars 8,000 gal. minimum f.o.b. place named:

		Sept. 4	One Year Ago
New York, 45% asphalt	(at terminal)	$0.055	$0.05
New York, 65% asphalt	(at terminal)	.06	.052
New York, binder	(at terminal)	.065	.06
New York, flux	(at terminal)	.04	.06
New York, liquid asphalt	(at terminal)	.06	.048
St. Louis, 40@50% asphalt		.0475	.0535
St. Louis, 50@60% asphalt		.0481	.0565
Chicago, 40–50% asphalt		.0525	.0525
Chicago, 60–70% asphalt		.055	.055
Dallas, 45% asphalt		.0495	.0495
Dallas, 55% asphalt		.0455	.0455
Dallas, binder		.061	.061
San Francisco, binder, per ton		11.00*	9.50*

* F.o.b. Oelum, Cal. Freight to San Francisco, 80c. per ton.

ASPHALT—Price per ton in packages (350-lb. bbls. or 425-lb. drums) and in bulk in carload lots, f.o.b. points listed:

	Package	Bulk
New York (*Standard refined Mexican*)	$19@20*	$15@16
Boston (*Mexican*)	21.00	16.00
Chicago (*Stanolind*)	21.00	15.00
San Francisco, *f.o.b. refinery*, Oleum, Cal.	17.00	11.00
Dallas (*Texas*)	27.10	21.10
Seattle, "*D*" *grade, California, f.o.b. Richmond,*	24.75	20.50
Denver (*California*)	24.00	
Minneapolis *f.o.b. Twin Cities* (*Stanolind*)	25.10	19.10
St. Louis (*Trinidad*)	**33.50**	**31.50**
Baltimore (*Mexican*)	**19.00**	14 **15**
Montreal (*Imperial*)	28.00	21.00
Atlanta (*Mexican*)	32.00	28.50
Detroit (*Mexican*)	22.00	18.00
Cincinnati (*Kentucky Rock*)		11.65
Maurer, N. J. (*Bermudez*)	28.00	26.00
Maurer, N. J. (*Mexican*)	20.50	17.50
Philadelphia (*Mexican*)	22.00	17.00
Kansas City (*Texas*)	27.30	22.30
Los Angeles ("*D*" *grade, California*)	20.15	11.00†
Birmingham (*Mexican*)	32.00	28.50

*In drums. †f.o.b. El Segundo Refinery.

NOTE—Barrels or drums are optional in most cities. About 6 bbls. to the ton, and from 4 to 5 drums; 200 to 300 gal. to the ton.

PAVING STONE—

New York (grade 1)	5-in. granite, 30 blocks per sq.yd.	$140.00 per M.
Chicago	About 4x8x4 dressed	3.60 per sq.yd.
	About 4x8x4 common	2.95 per sq.yd.
San Francisco	Basalt block 4x7x8	70.00 per M.
Boston	5-in. granite, 28 blocks per sq.yd.	**135.00** per M.
Atlanta	Granite	2.50 per sq.yd.
Detroit	5-in. Granite	3.00 per sq.yd.
Baltimore	Granite	2.85 per sq.yd.
Montreal	Granite	104.75 per M.
New Orleans	Granite, 4 x 8 x 4	3.25 per sq.yd.
Cincinnati	Granite	135.00 per M.
St. Louis	4x8x4 dressed	1.65 per sq.yd.
	4x8x4 common	1.65 per sq.yd.
Kansas City	Granite	3.85 per sq.yd.
Philadelphia	Granite	3.00@4.25 per sq.yd.
Minneapolis	Sandstone	2.74 per sq.yd.

FLAGGING—

New York	Bronx, 4 ft wide	$0.22 per sq.ft.
	Manhattan, 4 ft. wide	.22 per sq.ft.
	Queens, 5 ft. wide	.24 per sq.ft.
	6x24-in. cross-walk	1.20 per lin.ft.
Chicago	18 in. wide....No market	.... per lin.ft.

CURBING—*New York*: Bluestone per lin.ft., f.o.b. barge New York, 5 x 16 in., 85c.; 5 x 20 in., Queens, 95c. *St. Louis*: Class "A" straight, delivered, 5 x 16 in., 90c. per lin.ft.

WOOD BLOCK PAVING—

	Size of Block	Treatment	Per Sq.Yd.
New York (*delivered*)	3	16	$2.28
New York (*delivered*)	3½	16	2.48
Boston	3½	18	2.55
Chicago	4	16	3.20
Chicago	3½	16	2.90
St. Louis	3½	16	2.35
St. Louis	4	16	2.65
Seattle	4	16	Off market
Minneapolis	3½	16	2.75
Atlanta	3½	16	2.00
New Orleans	3	16	1.70
New Orleans	3½	16	2.10
New Orleans	4	16	2.50
Dallas	4	18	3.90
Baltimore	3½	16	None used
Montreal	4	16	4.50
Detroit	3	16	1.94
Detroit	4	16	
Cincinnati	3½	16	2.38
Kansas City	4	16	3.00
Philadelphia	4	16	None used

CONSTRUCTION MATERIALS

SAND AND GRAVEL—Price for cargo or carload lots to contractor is as follows, per cu.yd.:

	Gravel 1½ In. Sept. 4	Gravel 1½ In. One Year Ago	Gravel ¾ In. Sept. 4	Gravel ¾ In. One Year Ago	Sand Sept. 4	Sand One Year Ago
New York (*alongside dock*)	$1.75	$1.75	$1.75	$1.75	$1.00	$1.25
Denver	1.90	1.90	1.90	1.90	1.00	1.00
Chicago	2.75	2.00	2.75	2.00	2.75	2.00
St. Louis	1.45†	2.30†	1.65†	2.35†	1.18†	2.10†
Seattle	1.50	1.25	1.50	1.25	1.50	1.25
Dallas	2.38	2.38	2.38	2.38	2.00	1.89
Minneapolis	1.85*	1.85*	1.85*	1.85*	1.25	1.25
Cincinnati	1.40†	1.50†	1.40†	1.50†	1.35†	1.30†
San Francisco	2.15	2.15	2.15	2.15	1.50	1.50
Boston	1.40†	1.40†	1.40†	1.40†	1.00†	1.10†
New Orleans	3.00	2.85	3.00	2.85	1.25	1.25
Los Angeles	0.75†*	2.50†	0.85†*	2.50†	1.20†	1.75†
Atlanta	1.90†	1.90†	1.90†	1.90†	1.40†	1.24†
Detroit	*2.02*	1.62	2.02	1.62	**1.62**	2.02½
Baltimore	1.40	1.86	1.60	2.06	0.70†	0.80†
Montreal	1.25†	1.25†	1.50†	1.50†	1.25†	1.25†
Birmingham	2.00		2.00		1.30†	1.30†
Philadelphia	2.10	2.00†	2.10	2.00†	1.50	1.50
Kansas City	3.20†	1.75	3.20†	1.60	....	0.66*†

New York—Grits, $1.75 per cu. yd.; ready mixed, $2.00

Los Angeles—Freight from quarry, 70c. per ton, and is included in above price.

* At pit. † Per ton.

CRUSHED STONE—Price for cargo or carload lots f.o.b. city, unless stated otherwise, is as follows, per cu.yd.:

	1½ In. Sept. 4	1½ In. One Year Ago	¾ In. Sept. 4	¾ In. One Year Ago
New York	$1.75	$1.65	$1.85	$1.75
Chicago	**2.75**	2.00	**2.75**	2.00
St. Louis	1.75*	1.90	1.75*	2.00
Dallas	*2.40*	2.83	2.83	2.83
San Francisco	2.15	2.15	2.15	2.15
Boston	1.45*	1.60*	1.45*	1.60*
Minneapolis	1.75	2.00	1.75	2.25
Kansas City	1.50	1.50	1.50	1.50
Denver	3.50	3.50	3.50	3.50
Seattle	3.00	3.00	3.00	3.00
Atlanta	2.00*	2.00*	2.00*	2.00*
Cincinnati	1.90*	1.65*	1.90*	1.65*
Los Angeles (*at quarry*)	**1.15**		1.00	
Detroit	1.70	1.75	1.70	1.75
Baltimore	2.50	2.50	2.55	2.55
Montreal (del.)	2.25*	1.80*	2.25*	1.90*
Philadelphia	2.10	2.00	2.10	2.00
Pittsburgh	2.85	2.85	2.85	2.85
Cleveland	3.25*	3.25*	3.25*	3.25*
Birmingham	....	....	....	....

*Per ton.

CRUSHED SLAG—Price of crushed slag in carload lots, per net ton, at plants:

	1½-In.	¾-In.	Roofing	Sand
Youngstown District	$1.30	$1.40	$2.00	$1.30
Steubenville District	1.40	1.40	2.00	1.40
Ironton District	1.40	1.40	2.00	1.40
Easton, Catasauqua, Pa	0.85	0.90	2.50	
Birmingham, Ala	1.00	1.20	2.05	
Buffalo, N. Y., and Erie, Pa	1.25	1.25	2.25	1.25
Cleveland, Ohio	1.45	1.45	1.45	1.25
Eastern Pa. and Northern N. J	1.20	1.20	2.50	1.20
Western Pennsylvania	1.25	1.25	2.00	1.25
Longdale and Glen Wilton, Va	1.25	1.25	2.50	1.00
Toledo, Ohio	1.50	1.50	1.50	1.50

LIME—Warehouse prices:

	Hydrated, per Ton Finishing	Hydrated, per Ton Common	Lump, per Barrel Finishing	Lump, per Barrel Common
New York	$18.20	$13.10	$3.75*	$3.00@3.25*
Chicago	20.00	18.00		1.50†
St. Louis	24.00	20.00	18.75‡	18.75‡
Boston	20.00	15.00	3.90*	3.10*
Dallas	20.00	....	....	1.85†
Cincinnati	16.80	14.30	....	13.40‡
San Francisco	22.60	....	....	2.15†
Minneapolis	25.50	21.00 (white)	1.70†	1.40†
Denver	24.00	....	....	2.70†
Detroit	22.00	20.00	....	20.00‡
Seattle, *paper sacks*	24.00	.....	2.80†	
Los Angeles	18.00		4.00*	**2.70**†
Baltimore	24.25	17.85	2.55†	
Montreal	....	21.00	....	10.50‡
Atlanta	22.50	14.00	2.10†	1.45†
New Orleans	24.00	18.00	2.20†	2.20†
Philadelphia	23.00	16.00	1.92	1.24†
Kansas City	*17.75*	*16.00*	*2.45**	*2.10**
Birmingham	18.00	14.00	2.00†	1.75†

*Per 280-lb. bbl. (net). †Per 180-lb. bbl. (net). ‡Per ton—Refund of 10c. per bbl. Minneapolis quotes brown common lump lime; Kelly Is. white is $1.80, Sheboygan $1.70. New York quotes hydrated lime "on cars" in paper sacks; lump lime "alongside dealers docks" or "on cars."

NATURAL CEMENT—Price to dealers per bbl. for 500 bbl. or over, f.o.b., exclusive of bags:

	Sept. 4	One Year Ago
Minneapolis (Rosendale)	$2.80	$2.80
Kansas City (Ft. Scott)	*1.85*	1.50
Cincinnati (Utica)	1.72	1.72
Boston (Rosendale)	2.50	2.80
St. Louis (Carney)	2.35	2.35
Birmingham (Magnolia) pozzolan cement	2.10	2.10

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots f.o.b. points listed *without bags*. Cash discount not deducted.

	Sept. 4	One Month Ago	One Year Ago
New York, del. by truck	$2.50@2.60	$2.50@2.60	$2.70@2.80
New York, alongside dock to dealers	**2.15**	2.15	2.30
Jersey City	2.33	2.33	2.48
Boston	2.64	2.64	2.90
Chicago	2.20	2.20	2.20
Pittsburgh	2.19	2.19	2.24
Cleveland	2.39	2.39	2.46
Detroit	2.40	2.40	2.48
Indianapolis	2.41	2.41	2.41
Milwaukee	2.35	2.35	2.37
Duluth	2.19	2.19	2.25
Peoria	2.37	2.37	2.41
Cedar Rapids	2.40	2.40	2.48
Davenport	2.39	2.39	2.43
St. Louis	2.30	2.30	2.45
San Francisco	2.61	2.61	2.63
New Orleans	2.80	2.80	2.90
Minneapolis	2.42	2.42	2.50
Denver	2.84	2.84	2.84
Seattle	2.90	2.90	2.90
Dallas	2.05	2.05	2.25
Atlanta	2.35	2.35	3.00
Cincinnati	2.47	2.47	2.54
Los Angeles	**2.83**	2.75	3.16
Baltimore	2.90	2.90	2.65
Birmingham	2.40	2.40	2.70
Kansas City	*2.70*	2.82	2.90
Montreal	1.90	1.90	2.25
Philadelphia	2.41	2.41	2.75
St. Paul	2.42	2.42	2.50
Toledo	2.45	2.45	2.48

NOTE—Bags 10c. each, 40c. per bbl.; 20c. each in Canada, 80c. per bbl.

Current mill-prices per barrel in carload lots, without bags, to contractors:

Buffington, Ind	$1.95	Hudson, N. Y	$2.05
Universal, Pa	**2.35**	Leeds, Ala	1.95
Steelton, Minn	2.00	Hannibal, Mo	2.05
Fordwick, Va	2.05	Lehigh Valley District	1.95
Mitchell, Ind	**2.05**	Wyandotte, Mich	2.15
Iola, Kan	1.95	Alpena, Mich	**2.00**
Mason City, Ia	2.00	Richard City, Tenn	2.05
La Salle, Ill	2.05	Kingsport, Tenn	2.05

TRIANGLE MESH—Price per 100 sq.ft. in carload lots:

PLAIN 4-INCH BY 4-INCH MESH

Style Number	Weight in Pounds per 100 sq.ft.	Warehouse: Pittsburgh Mill	Chicago Mill	New York	St. Louis	Dallas	San Francisco
032	22	$0.95	$1.02	$1.24	$1.04	$1.13	$1.15
049	28	1.20	1.30	1.58	1.32	1.38	1.45
068	35	1.47	1.59	1.94	1.62	1.67	1.78
093	45	1.89	2.04	2.50	2.08	2.00	2.28
126	57	2.34	2.53	3.09	2.59	2.55	2.85
153	68	2.79	3.02	3.60	3.08	3.15	.....
180	78	3.20	3.47	5.22	3.54	3.47	.....
245	103	4.22	4.57	4.60	4.66	4.58	.....
287	119	4.88	5.28	6.44	5.39	5.26	5.94
336	138	5.66	6.13	7.39	6.25	6.11	.....
395	160	6.56	7.10	8.67	7.25	7.12	.....
		PAVING					
036P	17	$0.72	$0.78	$0.95	$0.79	$0.76	.....
053P	24	1.02	1.10	1.35	1.12	1.07	.....
072P	31	1.29	1.40	1.71	1.42	1.39	.....
097P	40	1.66	1.80	2.20	1.83	1.90	.....
049R	24	.....	1.10	.....	1.12	1.07	.....
067R	31	.....	1.40	.....	1.42	1.39	.....
089R	40	.....	1.80	.....	1.83	1.90	.....

In rolls, 48-, 52-, and 56-in. wide and in 150-, 200- and 300-ft. lengths. Galvanized is about 15% higher. Size of roll carried in New York warehouses, 48 in. wide x 150 ft. long, or 600 sq. ft.

EXPANDED METAL LATH—Prices in carload lots per 100 yd. for painted are as follows:

Weight in pounds	New York	Chicago	St. Louis	San Francisco	Dallas
2.2	$21.00	$19.00	$20.00	$24.00	*$23.50*
2.5	23.00	21.00	21.00	26.00	*25.00*
3.0	27.00	24.50	*24.50*	30.00	*28.50*
3.4	29.00	26.50	*26.50*	.....	*31.00*

BARS, CONCRETE REINFORCING—Current quotations per 100 lb.:

ROLLED FROM BILLETS

Inches	Warehouse, Uncut: Pittsburgh Mill	Birmingham	New York	Chicago	St. Louis	Dallas	San Francisco
¼ and larger..	*$2.10*@$2.15	$2.75	$3.24	$3.00	*$3.10*	$3.38	$3.35
⅜.....	*2.15*@ 2.20	2.90	3.34	3.10	*3.20*	3.43	3.45
½.....	*2.20*@ 2.25	3.00	3.44	3.20	*3.40*	3.48	3.55
⅝.....	*2.35*@ 2.40	3.25	3.64	3.40	*3.65*	3.63	3.75
¾.....	*2.60*@ 2.65	3.50	4.24	4.00	*4.30*	3.78	4.35

For size and cutting extras, manufacturers and distributers, see bar card of July 1, 1923.

ROLLED FROM RAILS

	Chicago	St. Louis	Dallas
¼ and larger	$2.70	$3.00	$3.08
⅜ in.....	2.80	3.05	3.13
½.....	2.90	3.10	3.18

	Chicago	St. Louis	Dallas
⅝.....	$3.10	$3.20	$3.30
¾.....	3.70	3.50	3.48
⅞.....	.....	.....	.....

BRICK—Contractors price per 1,000 in cargo or carload lots is as follows:

	Common: Sept. 4	One Month Ago	One Year Ago	Paving Block: 3-inch*	4-inch*
New York (del.).....	*$17.00*	$20.15	$23.65	$46.50	$53@54
New York (at dock)...	.....	16@17	20.00	.....	.....
Chicago.....	*12.00*	18.00	11.00	50.00	50.00
St. Louis, salmon.....	16@18	16@18	16@18	38@40	40@42.50
Denver, salmon.....	12.00	12.00	12.00	.....	.....
Dallas.....	14.10	14.10	13.10	35.00	.....
San Francisco.....	15.50	15.50	15.00	.....	.....
Los Angeles.....	15.00	15.00	15.50	(not used)	
Boston (del.).....	*21.00*	21.50	23.00	*47.00*	55.00
Minneapolis (del.).....	14.00	13.00	17@19	.....	.....
Kansas City.....	16.50	16.50	14.50	(no market)	
Seattle.....	15.00	15.00	13.00	.....	*42.50*
Cincinnati.....	17.00	17.00	17@20	40.00	45.00
Montreal.....	17.50	17.50	16.50	100.00†	68.00
Detroit (del.).....	17.50	17.50	18.50	38.50	41.50
Baltimore.....	18.00	18.00	21.00	40.00	.....
Atlanta.....	11.00	11.00	12.00	40.00	.....
New Orleans.....	19.50	19.50	18.75	.....	.....
Birmingham.....	12.50	12.50	13.50@16	(no market)	
Philadelphia.....	19.00	19.00	22.00	38.00	46.00
Pittsburgh (del.).....	16.00	16.00	16.00	.....	.....
Cleveland.....	16.00	16.00	16.00	.....	.....

* For paving blocks 3½x8½x3 and 3½x8½x4 respectively. † Imported.

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York: Sept. 4 on Trucks*	One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy N. J., Factory*
4x12x12...	$0.1162	$0.1263	$0.089	$0.125	$0.077@.086	$0.108	.....
6x12x12...	.1743	.1895	.114	.....	.103@.114	.156	.....
8x12x12...	.2179	.2369	.163	.215	.14 @.158	.244	.....
10x12x12...	.....	.....	.21	.....	.17 @.186	.....	$0.2786
12x12x12...	.....	.....	.25	.....	.21 @.23	.....	.3448

* 5 per cent off for cash.

	4x12x12	8x12x12	12x12x12
Boston.....	$0.125	$0.23	.....
Minneapolis (f.o.b. cars).....	.073	.12	$0.215
Minneapolis (delivered).....	.08	.13	.23
Cincinnati.....	.07485	.13745	....
Kansas City.....	.085	.145	.....
Denver.....	.085	.155	.188
Seattle (delivered).....	.11	*.20*	*.30*
Los Angeles.....	.085	.172	....
New Orleans.....	.14	.24	.....
Detroit (delivered).....	.1044	.1958	.2737
Montreal.....	.12	.225	.30
Baltimore.....	.125	.27	.....
Atlanta.....	.1004	.1674	.....
Dallas.....	.11	.20	.285
Birmingham.....	.11	.175	.....
Pittsburgh (delivered).....	.068	.128	.179
Cleveland.....	.08	.14	.....

San Francisco and New York quote on hollow partition tile.

STRUCTURAL MATERIAL—Following are base prices f. o. b. mill, Pittsburgh and Birmingham, together with quotations per 100 lb. from warehouses at places named:

	Pittsburgh Mill	Warehouse: Birmingham	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.....	*$1.95*@$2.15	$2.75	$3.34	$4.20	$3.25	$3.10	$3.40
Channels, 3 to 15 in....	*1.95*@ 2.15	2.75	3.34	4.20	3.25	3.10	3.40
Angles, 3 to 16 in., ¼ in. thick.....	*1.95*@ 2.15	2.75	3.34	4.20	3.25	3.10	3.40
Tees, 3 in. and larger...	*1.95*@ 2.15	2.75	3.34	4.20	3.30	3.10	3.40
Plates, ¼ in. thick and heavier.....	*1.70*@ *2.00*	2.50	3.34	4.20	3.25	3.10	*3.25*

RIVETS—The following quotations are per 100 lb.:

STRUCTURAL

	Pittsburgh Mill	New York: Sept. 4	New York: One Yr. Ago	Warehouse: Chicago	St. Louis	San Francisco	Dallas
½ in.....	$2.60	*$3.75*	$4.40	*$3.50*	$3.65	$5.00	$4.90
CONE HEAD BOILER							
½ in.....	*$2.90*	*$3.85*	$4.50	*$3.60*	$3.85	$5.20	$5.00
⅝ and ¾.....	*3.05*	*4.01*	4.66	*3.75*	*4.10*@*4.35*	*5.15*	5.15
⅞ and 1⅛.....	*3.30*	*4.25*	4.90	*4.00*	*4.50*	*5.50*	5.50

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh Mill	Birmingham	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire.....	*$2.80*	$3.75	$3.80	$4.10	$4.55	$3.24	$4.95
Cut.....	2.90	4.25	4.45	5.25	*5.00*	3.49	5.00

SHIP SPIKES—Current prices per 100 lb.:

In.	San Francisco: Galv.	San Francisco: Black	Seattle Black
½.....	$8.25	$6.20	$7.75
⅝.....	7.80	5.80	*5.65*
¾.....	7.65	5.65	5.50

Pittsburgh base in lots of 200 kegs or more, $3.25.

PREPARED ROOFINGS—Slate-surfaced roofing (red and green) in rolls of 108 sq.ft. costs $2.64 per roll to consumers in less than carload lots f.o.b. Philadelphia.

Single shingles, red and green slate finish, cost $6.95 per square (sufficient to cover 100 sq.ft.) in less than carload lots, f.o.b. Philadelphia. Strip shingles (4 in 1) f.o.b. Philadelphia, l.c.l., $6.05 per square.

ROOFING MATERIALS—Prices f.o.b. New York, to consumers in less than carload lots:

Tar felt (14 lb. per square of 100 sq.ft.) per ton.....	$85.73
Tar pitch (in 400-lb. bbl.), per 100 lb.....	2.13
Asphalt roofing (in barrels), per ton, f.o.b. plant*.....	40.50
Asphalt felt (light), per ton, f.o.b. plant*.....	87.75
Asphalt felt (heavy), per ton, f.o.b. plant*.....	87.75

* Delivered in Metropolitan Dist., $2.00 additional.

WINDOW GLASS—United inches, 25, bracket size 6x8 to 10x15, single thickness "AA," 82 per cent; "A," 86 per cent; "B," 88 per cent. Double thickness "AA," 82 per cent; "A," 85 per cent; "B," 88 per cent discount from jobbers list at New York warehouses.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

Blue Annealed	Pittsburgh Large Mill Lots	St. Louis	Chicago	San Francisco	New York
No. 10.....	*$2.65*@*2.70*	$3.90	$3.80	$4.75	$4.14
No. 12.....	*2.75*@*2.80*	3.95	4.05	4.80	4.19
No. 14.....	*2.85*@*2.90*	4.00	4.10	4.85	4.24
No. 16.....	*3.05*@*3.10*	4.10	4.20	4.95	4.34
Black					
*Nos. 18 and 20.....	*3.35*	4.45	4.55	5.35	4.65
*Nos. 22 and 24.....	*3.40*	4.50	4.55	5.40	4.70
*No. 26.....	*3.45*	4.55	4.60	5.45	4.75
*No. 28.....	*3.50*	4.65	4.50	5.55	4.85
Galvanized					
No. 10.....	*$3.60*	4.65	4.60	5.25	4.90
No. 12.....	*3.70*	4.75	4.70	5.35	5.00
No. 14.....	*3.70*	4.75	4.70	5.35	5.00
Nos. 17 to 21.....	*4.00*	5.05	5.00	5.65	5.30
Nos. 22 and 24.....	*4.15*	5.20	5.15	5.80	5.45
*Nos. 25 and 26.....	*4.30*	5.35	5.30	5.95	5.55
*No. 28.....	*4.60*	5.65	5.50	6.25	5.85

*For painted corrugated sheets add 30c. per 1,000 lb. for 5 to 28 gage; 25c. for 19 to 24 gages: for galvanized corrugated sheets add 15c., all gages.

LINSEED OIL—These prices are per gallon:

	New York: Sept. 4	New York: One Year Ago	Chicago: Sept. 4	Chicago: One Year Ago
Raw in barrels (5 bbl. lots).....	$1.07	$0.96	$1.05	$1.14

WHITE AND RED LEAD—In 100-lb. kegs, base price in cents per pound:

	Dry		In Oil	
	Sept. 4	1 Yr. Ago	Sept. 4	1 Yr. Ago
Red	14.75	14.00	16.25	15.50
White	14.75	14.00	14.75	14.00

LUMBER

Prices wholesale, per M. ft. b.m., to dealers in carload lots, f.o.b.

San Francisco—Prices of rough Douglas fir No. 1 common, in carload lots to dealers at yards. To contractors, $2 per M. ft. additional.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft	25 to 32 Ft.
3x3 and 4	*$28.00*	*$29.00*	*$30.00*	$35.00
3x6 and 8	*28.00*	*29.00*	*30.00*	35.00
4x4-6 and 8	*28.00*	*29.00*	*30.00*	35.00
3x10 and 12	*28.00*	*29.00*	*30.00*	35.00
3x14	34.00	34.00	36.00	38.00
4x10 and 12	*28.00*	*29.00*	*30.00*	35.00
4x14	34.00	34.00	36.00	38.00

	24 Ft. and Under	25 to 32 Ft.	33 to 40 Ft.
6x10	*$30.00*	*$32.00*	*$34.00*
6x14	36.00	38.00	40.00
8x10	*30.00*	*32.00*	*34.00*
8x14	36.00	38.00	40.00

New York and Chicago—Wholesale prices to dealers of long leaf yellow pine.

	New York*		Chicago	
	20 Ft. and Under	22-24 Ft.	20 Ft. and Under	22-24 Ft.
3x4 to 8x8	$42.00	$43.00	*$41.50*	*$42.50*
3x10 to 10x10	48.00	49.00	*46.50*	*42.50*
3x12 to 12x12	53.00	54.00	*51.50*	*43.50*
3x14 to 14x14	62.00	63.00	57.50	*44.50*
3x16 to 16x16	68.00	69.00	67.50	*46.50*
3x18 to 18x18	.....	.....	77.50	*48.50*
4x20 to 20x20	.....	.....	86.50	*51.50*

*Wholesale price to dealers; to contractors, delivered from lighters or cars to ob, $5 additional. Short leaf pine costs $3 per M. less.

Over 24 ft.—Add $1 for each additional 2 ft. in length up to 30 ft. for sizes 12 x 12 and under, for sizes over 12 x 12 add $2, for merchantable add $2 to sizes 10 x 10 and under.

Other Cities	8x8-In. x 20 Ft. and Under				12x12-In. 20 Ft. and Under	
	P.	Fir*	Hemlock	Spruce	P.	Fir*
Boston	*$56.00*	$56.00†	$52.00	$50.00	*$63.00*	$65.00†
Seattle	.....	29.50	.....	.....	.....	24.00
New Orleans	29.00	.....	.....	.....	39.00	.....
Baltimore	32.50	49.25	53.00	60.00	38.00	49.75
Cincinnati	40.00	74.00	74.00	88.00	44.00	78.00
Montreal	50.00	58.00	.....	.....	60.00	65.00
Los Angeles	.....	38.00	.....	.....	.....	38.00
Denver	.....	34.75	34.75	34.75	.....	34.75
Minneapolis	40.00	37.75	39.00	.....	43.10	37.75
Atlanta	*32.00*	.....	.....	.....	*35.00*	.....
Dallas	52.25	.....	.....	.....	57.20	.....
Kansas City	*38.25*	.....	.....	.....	*48.25*	.....
Birmingham	20@30	.....	.....	.....	25@33	.....
Philadelphia	42.00	36.00	41.50	43.00	52.00	37.00
Detroit	40.75	46.75	.....	.....	49.75	46.75
St. Louis	42.00	.....	.....	.....	54.00	.....

	1-In. Rough, 10 In. and Under x 16 Ft.			2-In. T. and Gr. 10 In. x 16 Ft.	
	P.	Fir*	Hemlock	P.	Fir*
Boston	*$45.00*	$46.00†	$45.00	$52.00	$51.00†
Seattle	.....	25.00	.....	.....	29.00
New Orleans	67.00	.....	.....	33.00	.....
Baltimore	55.00	44.00	44.00	34.00	50.00
Cincinnati	75.00	80.00	75.00	38.00	88.00
Montreal	56.00	50.00	45.00	45.00	45.00
Los Angeles	.....	*32.00*	.....	.....	.....
Denver	.....	*32.25*	*32.25*	.....	30.25
Minneapolis	43.00	35.25	35.50	37.00	32.25
Atlanta	*20.00*	.....	.....	*30.00*	.....
Dallas	52.25	.....	.....	55.73	.....
Kansas City	*70.00*	.....	.....	*75.00*	.....
Birmingham	.....	.....	.....	24@42	.....
Philadelphia	29.00	36.00	41.00	42.00	35.00
Detroit	38.75	35.00	.....	44.00	36.75
St. Louis	41.00	.....	.....	30.00	.....

Birmingham—Quotes carload lots, f.o.b. sidings; $4.00 additional per M.ft. to contractors.
Boston and Cincinnati—Prices to contractors in carload lots, f.o.b.
Denver—Quotes dealers price to contractors on large projects.
St. Louis—Wholesale price to contractors, f.o.b. cars, $3 per M.ft. additional.
Seattle—Price to contractors, delivered.
Dallas—Wholesale to contractors, $10 per M.ft. additional.
*Douglas fir. †Prime.

PILES—Prices per lineal foot, pine piles with bark on, f.o.b. New York.

Diameters	Points	Length	Barge	Rail
12 in. at butt	6 in.	30 to 50 ft.	$0.14½	$0.18½
12 in.—2 ft. from butt	6 in.	50 to 59 ft.	.19	.23½
12 in.—2 ft. from butt	6 in.	60 to 69 ft	.21½	.25½
14 in.—2 ft. from butt	6 in.	50 to 69 ft.	.25½	.34
14 in.—2 ft. from butt	6 in.	70 to 79 ft.	.27½	.36½
14 in.—2 ft. from butt	5 in.	80 to 89 ft.	.35	.41

MISCELLANEOUS

STEEL SHEETPILING—The following price is base per 100 lb. f.o.b. Pittsburgh, with a comparison of a month and a year ago:

Sept. 4	One Month Ago	One Year Ago
$2.05@2.15	$2.30@2.40	$2.65

WIRE ROPE—Discounts from list price on regular grades of bright and galvanized are as follows:

	Eastern Territory New York and East of Missouri River
Plow steel round strand rope	35%
Special steel round strand rope	30%
Cast steel round strand rope	20%
Round strand iron and iron tiller	5%
Galvanized steel rigging and guy rope	7½%
Galvanized iron rigging and guy rope	+12½%

California, Oregon, Nevada and Washington Discount: 5 points less than discount for Eastern territory.
Wyoming, New Mexico and Colorado: Discount 5 points less than discount for Eastern territory.
Arizona: Discount 10 points less than discount for Eastern territory.
Montana, Idaho and Utah: Discount 10 points less than discount for Eastern territory.
North Dakota, Nebraska, Kansas, Oklahoma and Texas: Discount 5 points less than discount for Eastern territory.

MANILA ROPE—For rope smaller than ¾-in. the price is ½ to 2c. extra; while for quantities amounting to less than 600 ft., there is an extra charge of 1c. The number of feet per pound for the various sizes is as follows: ¼-in., 8 ft., ⅜-in., 6; ½-in., 4½; ⅝-in., 3½; ¾-in., 2 ft. 10 in.; 1¼-in., 2 ft. 4 in. Following is price per pound for ¾-in. and larger, in 1200-ft. coils:

Boston	$0.17½@.23	New Orleans	$0.17½
New York	.18½	Los Angeles	.19
Chicago	.18	Seattle	.17
Minneapolis	.19½	St. Louis	.18½
San Francisco	.17	Montreal	.16
Atlanta	.19	Detroit	.20
Denver	.19½@20½	Baltimore	.18
Cincinnati	.21	Kansas City	.20½
Dallas	.21	Birmingham	.23
Philadelphia	.18½		

EXPLOSIVES—Price per pound of dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.27	$0.295
Boston	.23	.25
Kansas City	.2125	.2325
Seattle	.165	.19
Chicago	.22	.25
Minneapolis	.1917	.2123
St. Louis	.22	.245
Denver	.2025	.2275
Dallas	.225	.302
Los Angeles	.1875	.2125
Atlanta	.23	.255
Baltimore	.22	.23
Cincinnati	.22	.245
Montreal	.195	.235
Birmingham	.21	.24
New Orleans	.235	.29
San Francisco	.1625	.1925
Philadelphia	.215	.24

CHEMICALS—Water and sewage treatment chemicals, spot shipments in carload lots, f. o. b. New York:

Sulphate of aluminum, in bags, per 100 lb.	$1.35@1.40
Sulphate of copper, in bbl., per 100 lb.	4.65@4.80
Soda ash, 58%, in bags, per 100 lb.	1.25@1.45
Chlorine, liquid, cylinders, 100 lb., per lb. (f.o.b. works)	.05½@.07½
Hypochlorite of lime (bleaching powder) in drums, per 100 lb.	2.25@2.35

FREIGHT RATES—On finished steel products in the Pittsburgh district, including plates, structural shapes, merchant steel, bars, pipe fittings, plain and galvanized wire nails, rivets, spikes, bolts, flat sheets (except planished), chains, etc., the following freight rates are effective in cents per 100 lb., in carloads of 36,000 lb.:

Baltimore	$0.31	Detroit	$0.29
Birmingham	.58	Kansas City	.735
Boston	.365	New Orleans	.67
Buffalo	.265	New York	.34
Chicago	.34	Pacific Coast (all rail)	1.15*
Cincinnati	.29	Philadelphia	.32
Cleveland	.215	St. Louis	.43
Denver	1.15*	St. Paul	.60

* Minimum carload, 50,000 lb., structural steel only; 80,000 lb., for other iron or steel products.